8Cd

A NEW AND

COMPENDIOUS SYSTEM

OF

HUSBANDRY.

CONTAINING THE MECHANICAL, CHEMICAL,
AND PHILOSOPHICAL ELEMENTS OF

AGRICULTURE.

ILLUSTRATING

I. The Properties of different Soils.

II. The Properties of Manures, and their Effects.

III. The moſt advantageous Method of applying Manures on the different Soils.

IV. The Improvement of Lands.

V. The great Superiority of, and the numerous Advantages reſulting from the *New* and *Drill*, to the common Mode of Huſbandry.

VI. The Imperfections of the *old Mode* of Cultivation clearly pointed out, with a *new Method* of *Culture*, founded on Obſervations, Facts, and Experiments.

VII. Experiments on Grain of different Sorts.

VIII. Experiments on Turnips, with the moſt effectual Recipe for preventing the Ravages of the Fly.

IX. Experiments on Fruit Trees and Flowers, with an Account of a new, cheap, and effectual Manure.

X. Experiments on fattening of Hogs.

XI. A Copperplate and Deſcription of a *new-invented* PATENT DRILL MACHINE, for planting all Sorts of Seed, Grain and Pulſe; univerſally acknowledged to be ſuperior to any hitherto conſtructed.

XII. The Application of Subſtances for the Analyſis of Soils and Manures.

With many other uſeful and intereſting SUBJECTS.

By GEORGE WINTER.

K.

Member of the SOCIETY of ARTS in London: Of the BATH AGRICULTURE SOCIETY.
Honorary Member of the ODIHAM AGRICULTURE SOCIETY.
And of the Society for the PARTICIPATION of USEFUL KNOWLEDGE, at NORWICH.
And a PRACTICAL AGRICULTURIST.

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M.DCC.LXXXVII.

19

An Explanation of provincial Words, made uſe of in this Treatiſe.

AIL. The long prickly part, growing on one end of a grain of barley.

HAYNE. To ſecure from cattle, to preſerve the graſs for mowing.

POACHED. Horſes or cattle walking over wet land, and making deep impreſſions thereon with their feet.

POOKS or POOKING. Small mows made in the field.

RUTS. Hollow paſſages made in the land by moles, rats, or mice.

STUMPING. Beating off the ails of barley by an iron, made in the form of a gridiron.

TILLER. To branch or ſhoot out many ſtalks from the root.

TYNES. The teeth of a harrow.

MVSEVM
BRITAN
NICVM

TO HIS

GRACE

THE

DUKE of BEAUFORT.

MY LORD,

HAVING the pleaſure of living in the ſame county with your Grace, and not many miles diſtant from your reſidence, I was particularly ambitious of being permitted to dedicate the following Treatiſe to you, as well on account of your being a promoter of every degree of *uſeful* knowledge, as by your judicious conduct in public and private life, ſetting an example moſt worthy of imitation.

Greater improvements having been made in all the other arts than in agriculture, which of all ſciences is the moſt beneficial to mankind, the following attempt to improve in that line can claim no other merit than a ſincere intention of endeavouring to promote and increaſe, upon the moſt rational principles, the real ſtrength and wealth of the kingdom. With this view I flatter myſelf, I ſhall obtain the approbation and patronage of your Grace; and ſhall think myſelf happy if I may be deemed to have been not altogether an uſeleſs member to ſociety.

I have the honour to be, with

The higheſt reſpect and eſteem,

Your GRACE's

Moſt obedient and moſt

Devoted humble ſervant,

GEO. WINTER.

CHARLTON,
Glouceſterſhire.
March 15th, 1787.

A SHORT

ADDRESS

TO THE

PUBLIC.

I THINK it neceſſary to inform the Reader, that the following minutes and obſervations were only regiſtered for my own private inſpection, and never intended for publication till laſt September; when the repeated ſolicitations of my friends and acquaintance became irreſiſtible. I flattered myſelf, that in the courſe of three months I ſhould have been able to have properly arranged and tranſcribed all my remarks, and even had them publiſhed in January, agreeable to my firſt propoſals, but unexpected buſineſs intervening, with the numerous letters and perſonal applications for my Treatiſe, laid me under the neceſſity of conveying my remarks to the printer as ſoon as they were copied, (without being reviſed or corrected,) that I might thereby endeavour the more punctually and expeditiouſly to execute my engagements. Theſe circumſtances will, I truſt, ſufficiently apologiſe for errors, incorrectneſs, and irregular arrangements; and convince my readers, that the height of my ambition has been to convey my ideas in ſuch a manner as to be intelligible.

POSTSCRIPT.

THE following ſubſtances are particularly recommended for promoting and increaſing the vegetative and prolific properties of grain and ſeed. Gentlemen and gardeners, who are floriſts, by making a few experiments, may be ſoon convinced of their utility. Soapy water; ſcraped or powdered ſoap; wood, or any other vegetable aſhes, finely ſifted: A ſmall quantity of either, mixed with the ſurface of the earth will prove very fertilizing.

Wood aſhes rank firſt after oil, on the liſt for promoting the growth of turnips, as in page 247; it is alſo the only manure that increaſes the crop when applied immediately with the grain, as in page 262. A ſmall quantity of ſifted wood-aſhes mixed with carrot, turnip, or any other ſeed or grain, drilled, will promote their growth and increaſe.

E R R A T A.

The Reader is reſpectfully requeſted to correct the following Errors with his Pen.

Page 4, line 20, *eraſe* now. 39; 17, *eraſe* with dung or. 52; 4, 6, *eraſe* lime, *inſert* calcarous earth. 56; 9, *eraſe* explode, *inſert* diſapprove of. 62; 10, add t to op-dreſſing. 63, 1, *eraſe* (excepting the alkaline manure). 67; 14, *eraſe* for, *inſert* to. 75; 1, 9, *eraſe* are, *inſert* is. 128; 16, *eraſe* one, *inſert* an. 146; 147, 149, to buſhels ſold for, *add* and ſtraw. 159; 9, *eraſe* next. 163; 21, *eraſe* vegetables are, *inſert* grain is. 164; 1, *eraſe* they, *inſert* it will. 165; 14, *add* ly to unequal. 168, 19; *eraſe* nay. 172; 3, 15, after happy, *add* it is; *eraſe* a kind of ſympathy, *inſert* the aſſiſtance they afford each other. 213; 21, after ſix, *add* or ſeven. 216; 4, *add* eſs to wilderneſs. 223, 14; *add* ly to ſeeming. 229; 13, *eraſe* is, *inſert* are. 231, 11, *eraſe* their. 234; 4, *eraſe* hogs varrowed, *inſert* pigs farrowed. 253; 15, *eraſe* three, ſeven, *inſert* thirty, ſeventy. 262; 3, after inſtance *add* (excepting the wood aſhes, which in-creaſed the crop). [The reader is particularly requeſted to rectify this omiſſion.] 265; 9, *eraſe* current, *inſert* acceſs. 288, *eraſe* ſix, *inſert* ſeven. 318; 16, *eraſe* pounds, *inſert* guineas. 327, *eraſe* jerinams, *inſert* geraniums. 335; 1, 15, *eraſe* black, *inſert* blue. *add* l to oads. — s to be *added* or *eraſed* in ſeveral parts.

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A
NEW AND COMPENDIOUS
SYSTEM
OF
AGRICULTURE.

On AGRICULTURE.

THE numerous Volumes which have already been publiſhed on Agriculture, by authors of the greateſt abilities and experience, render it in ſome meaſure, a kind of preſumption to attempt making public any further Obſervations and Experiments. But when I reflect that Agriculture is not reduced to a regular ſyſtem, or arrived at that degree of perfection which other Arts, Manufactures, and Sciences have attained; and as it is univerſally acknowledged that every perſon who contributes, or endeavours to contribute to the public good, deſerves applauſe; I truſt that ſuch obſervations and improvements, as tend to promote the public welfare, will be deemed worthy of ſome attention.

Health,

Health, one of the greateſt bleſſings mankind can enjoy on this ſide of the grave, has for many years paſt, obliged me to reſide the greateſt part of my time in the country. Activity and inclination induced me to make practical Agriculture and Improvements in Huſbandry, my amuſement and principal ſtudy.

The experiments I have made, with quotations from authors (whoſe veracity may be depended on, and whoſe experiments I deemed the moſt truly advantageous) were originally minuted at my leiſure hours, and intended only for my own private inſpection and future inſtruction; that I might thereby avoid errors, and be enabled to purſue the moſt advantageous plan. The repeated ſolicitations of my friends and acquaintance, united with the idea I now entertain, that every member of ſociety ought to communicate what he has diſcovered, induced me to publiſh the preſent Treatiſe; which I have endeavoured to write in ſuch plain language, as may ſuit the loweſt capacity.

The multiplicity of improvements that have been lately made in Arts, Sciences, Mechanics, and Manufactures, ſhould animate the Farmer to be no leſs attentive to Agriculture; which is ſo neceſſary for the ſubſiſtence and welfare of mankind in this and every other kingdom. The moſt illuſtrious heroes, philoſophers, and poets among the antients, ſtudied to encourage, improve, and even practiſed Agriculture. The moſt noble Roman Conſuls and Dictators were taken from the plow; the Senators of that once flouriſhing people, and the moſt learned men of all ages, made Agriculture their chief ſtudy and employment; eſteeming it to be the original and genuine ſource of the ſtrength, wealth, and proſperity of every nation.—The nobility and moſt learned and ingenious men of the preſent age, animated with the public welfare, have condeſcended not only to ſtudy and practiſe Agriculture, but likewiſe to encourage and promote this nobleſt of Arts with indefatigable zeal. It is to ſuch men of underſtanding and liberal ſentiments, the public are indebted for the very great improvements ſo lately made in Agriculture, and all other Arts.

Every man whoſe natural abilities have been cultivated by education, ſhould certainly ſtudy the improvement of ſuch Arts and Sciences, as tend to promote the public welfare.

Man was not born merely to eat, drink, ſleep, or to ſpend his time in hunting, ſhooting, gaming, idleneſs, diſſipation, and ſenſual gratifications; but to be induſtrious and uſeful to ſociety; and ought to leave ſome record of his actions, as a teſtimonial of his endeavours at leaſt to be uſeful, to the preſent and future generations.

Men purſue different objects, as their inclinations and fancies lead them; but of all the Arts, Agriculture when properly conducted, is one of the moſt uſeful, profitable, pleaſing, rational, and healthful amuſements in life.

The Agriculturiſt, whilſt riding or walking round his farm, fully enjoys the ſweet refreſhing breeze, ſo neceſſary to the preſervation of his health; and while he attends to his buſineſs, may entertain himſelf with rural ſports. Every field and experiment preſent new objects to his view; pleaſing reſearches into the Works of Providence, ſuch as the different forms and growth of plants and grain; analyſing the great diverſity of ſoils and manures, that he may thereby aſcertain their properties, and be beſt enabled to deſtroy the particles that are injurious to vegetation, and enrich the ground; which, with the ſtudy of mechanical powers, are uſeful, pleaſing, profitable, and innocent amuſements, and furniſh the active mind with full employment.

The practice of Agriculture is in general confined, either to perſons who have not had a ſufficient education to enable them to keep regular accounts; or who are inattentive, and do not chuſe to be at that trouble; without which it is impoſſible to aſcertain the profits and loſs thereon; hence they cannot poſſibly attain the truth.

Enabled from my own experience, the regular accounts I have kept of each ſeparate field, and obſervations made on the mode of my neighbours cultivation; I may venture to aſſert, that many real loſſes are ſuſtained by improper management; ſuch for inſtance, as not allowing a ſufficient number of plowings and harrowings to pulverize and clear the land of weeds; the application of raw dung unmixed with earth, immediately for the crop, harbouring and nouriſhing inſects and weeds, which greatly injure and often deſtroy the crops of grain; or an improper ſucceſſion of crops. —The produce of ſeveral fields, of the ſame kind of grain, are frequently ſtacked or houſed promiſcuouſly together. If a farmer is aſked why he does not keep them ſeparate, his anſwer is, the hurry of harveſt and the unfavourable ſeaſon, prevent ſuch practice; therefore he cannot aſcertain the increaſe of the different lands. When a farmer cannot keep the produce of each ground ſeparate, he will find but very little trouble to cut two ſquare perches of the beſt, and the ſame quantity of the worſt part of his crop; which carried into the barn and threſhed out, will employ but little time; if he will proportion the amount of the number of perches ſo cut, to 160, (which an acre contains) the produce per acre of ſuch field may be eaſily aſcertained; and ſhould be immediately minuted in his book. He will ſoon be convinced of the utility of keeping regular accounts; he will thereby be beſt inſtructed whether two, three, or more plowings; if manured with lime, ſoaper's aſhes, dung, or compoſt; when applied, with the number of loads per acre; the time of ſowing, and the courſe of crops preceding; are the moſt advantageous.

Should the amount of ſo ſmall a quantity as four or ſix perches of land be difficult to calculate by meaſure, it may be eaſily weighed, and proportioned according to the weight of a buſhel of the ſame produce. Theſe calculations may be expeditiouſly made when the hurry of the day is over, or in wet weather, when other buſineſs does not interfere. By minuting and regiſtering ſuch accounts in a regular manner,

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ner, they can be referred to at any future period. The Agriculturiſt will thereby be enabled to avoid the wrong, and to purſue the beſt and moſt advantageous method. Such a plan will ſoon become habitual, amuſing, inſtructive, and profitable.

Another material circumſtance ſhould be ſtrictly attended to; that of keeping no more horſes than are eſſentially neceſſary for the work of his farm. Uſeleſs horſes are an additional expence, conſequently leſſen the farmer's gain; and as horſes and ſervants are kept at a certain expence, the plowing of every acre of ground ſhould be accordingly charged; otherwiſe the farmer deceives himſelf, and his regiſters muſt prove erroneous.

The accounts of my experiments in this Treatiſe, will ſufficiently elucidate the forms I have made uſe of; which I deem to be the moſt ſimple, eaſy, and beſt adapted to the meaneſt capacity.

Farmers may be poſſeſſed of great natural abilities and knowledge in the common mode of their anceſtors; but every farmer is not a ſcholar, mechanic, chemiſt, or philoſopher. Their knowledge, and the methods they purſue in general, extend no further than that of their predeceſſors, or the cuſtom of the country where they reſide. Any diſcoveries made by them are reſerved to themſelves, and themſelves only benefit by it; but men of ingenuous and liberal diſpoſitions, no ſooner make diſcoveries, than they are communicated to the public.

Experiments can be of little uſe, when extended no further than for our own private inſtruction; and reaſoning without experiments, avail but little in the practical Arts. Theory without practice, is ſimilar to a ſhadow without ſubſtance. But when reaſoning is founded on ſcience, combined with experiments minutely attended to, it is from thence only the ingenious Artiſt or Agriculturiſt is enabled to draw ſuch concluſions as are of real utility.

The great and general ambition of farmers is, to occupy large farms; the more they poſſeſs, the greater conſequence they think themſelves of;—but one acre of land properly managed, will produce more than double by improper cultivation.

Were farmers to occupy no more ground than their capitals would admit of cultivating in a maſterly manner, they would ſoon be convinced of the great advantages ariſing therefrom. They would have no reaſon to complain of ſcanty crops, which are generally occaſioned by ſome imprudent management; ſuch as applying manures at improper ſeaſons, or not adapted for the ſoil; or not ſufficiently pulverizing the ground; or the ſucceſſion of impoveriſhing, without the intervention of ameliorating crops; or the treading of corn after it is ſowed, by frequent harrowings and rolling to make the ſurface fine and even, when at the ſame time the under ſtratum is, for want of being ſufficiently plowed, and by the treading of the horſes or oxen, ſo hardened, as entirely to deſtroy the ſeed the cattle tread on, (particularly in wet and ſtiff ſoils); or prevent the roots and tender fibres from extending themſelves in ſearch of food. Vegetables cannot any more than animals, attain their proper growth and ſtrength without ſufficient nouriſhment. I do not mean to inſinuate that all ſoils are capable of producing crops equally luxuriant; I only wiſh to be underſtood, that there is no land, of any ſort whatever, (which has a ſufficient depth of mould for plowing) but what may be rendered fertile by prudent cultivation, and the application of proper manures; and in proportion to their different degrees of natural richneſs, be managed in ſuch a manner, as to produce luxuriant and profitable crops of ſome ſpecies of vegetables: And that by bad conduct, good ſoils oftentimes produce but ſcanty crops; when the blame is too frequently imputed to their natural poverty. Hence for inſtance, in the brewing of beer, in the baking of bread, the materials may be of the very beſt quality, yet, from the want of care and proper management, both are ſpoiled, or greatly injured; ſo it is with land.

Experience and daily obſervations convince me, that the beſt of ſoils, when they are not properly pulverized, or ſufficiently plowed and harrowed, will produce very ſcanty crops; but let them have an extra plowing or more (particularly ſtiff and loamy lands) and it will amply repay the Agriculturiſt for his extra labour;—hence, ſavings in huſbandry often produce poverty. Whereas were farmers to occupy no more land than they can cultivate in a maſterly, inſtead of a ſlovenly manner, they would very ſoon enjoy the great advantages and profits ariſing from ſuch conduct.——A farmer ſhould always be maſter of his farm, but if the farm is the farmer's maſter, loſs and diſappointment muſt inevitably enſue.

The practice of huſbandry requires precept, reflection, and ſtudy. Agriculture cannot be benefited by theory alone; but when theory is united with repeated experiments and facts, Agriculture, as all other Arts, may by this means be reduced to a regular ſyſtem.

The principles of Agriculture are deduced from Mechanics, Chemiſtry, and Natural Philoſophy.

Of MECHANICS.

MECHANICS are a branch of practical Mathematics, which conſider the nature and laws of motion and moving powers, with their effects in machines, which are made ſubſervient to the various purpoſes of mankind; and it is by the knowledge of this ſcience, that the greateſt improvements are made of every power and force in nature; by which any work may be more expeditiouſly executed, and at the leaſt Expence.

In all well managed manufactories the ſmalleſt ſavings of expence in materials, as well as labour, are never neglected.

Thoſe Articles which may appear trifling and very inconſiderable at firſt ſight, muſt on a ſmall ſcale in a few years, or in an extenſive line of buſineſs in one year, amount to a very conſiderable ſum. Therefore, why ſhould not Agriculture admit of a ſimilar compariſon with Manufactures? This Art is certainly of more real conſequence to the community.

The very great advantages derived from machines, in Manufactures, invented by ingenious men of the firſt abilities and fortunes in that line, are ſufficiently known.

The great and good effects of new inventions in Mechanics, are, by the wiſdom of the legiſlature, well ſecured. Individuals are protected againſt the oppreſſions, and unjuſtifiable combinations of avaricious and ſervile imitators; who may be compared to the drones, ſupported by the labours of the induſtrious bee:—Such ſecurity to inventions, encourages the ingenious artiſt to riſque his labour and property in new and uſeful attempts.

Of CHEMISTRY.

CHEMISTRY is an art by which mixed bodies are ſeparated, or reduced into their component parts; thereby the ſeveral properties of ſoils and manures are diſcovered; that ſuch manures may be applied, as will deſtroy any bad qualities that prove hurtful and poiſonous to vegetation; and which fertilize the ſoil.

As all lands differ materially in their qualities, ſo different manures ſhould be accordingly applied.

Of SOILS.

A SANDY SOIL.

SANDY or gravelly Soils have no coheſion of their parts. Sand too readily admits the heat of the ſun to the roots of the plants, by which they are ſcorched and deſtroyed; and has not ſufficient tenacity to afford ſecurity againſt ſevere colds and hard froſt. Sand, without the mixture of earth, contains no oleaginous or other particles, that can contribute to vegetation; rain and moiſture paſs through it too eaſily to afford nouriſhment for plants; therefore the dung of horned cattle, (which is rich and cooling) mixed with clay or marle, is the moſt coheſive and enriching manure, will the longeſt retain moiſture, and at the ſame time convey proper nouriſhment; hence it is beſt adapted to ſuch ſoils; and in proportion to the quantity of loam mixed with the ſand, its tenacity and vegetative properties are increaſed or decreaſed.

Green crops of turnips, buck-wheat, clover, or vetches plowed in, or fed with ſheep hurdled thereon, greatly enrich ſuch ſoils. Green crops when plowed in, ſhould be immediately rolled with a heavy ſtone roller, which conſolidates the looſened earth, cauſes a ſpeedy fermentation, produces a mucilaginous matter, which gives tenacity to the ſoil, and is converted into nouriſhment for plants.

Of a CLAY SOIL:

CLAYEY Soils differ as materially as ſandy ſoils. The oleaginous and earthy particles of ſome kinds of clay, are ſo cloſely combined as to retain water, which is permitted to eſcape only by evaporation.—All ſorts of clayey ſoils contain more or leſs oil, in proportion to their tenacity. A tough clay retains moiſture ſo much, as to rot the ſeeds and roots of plants. Clay does not admit the free acceſs of heat and air, (which are eſſentially neceſſary for promoting vegetation,) and it is ſo baked and hardened by the heat of the ſun, as to prevent the tender roots and fibres of plants from extending themſelves in ſearch of food. Hence ſuch manures as will open its pores, deſtroy its adheſion, and correct its bad qualities, ſhould be applied. Lime, coal, and ſoaper's aſhes, are beſt adapted for clayey and ſtiff ſoils when they are firſt plowed.

Of a LOAMY SOIL.

LOAM is a medium between light and ſtiff ſoils; differs in quality as materially as either.

Black and hazle colour ſoils are generally the richeſt, and moſt proper for the ſupport of vegetables, as they contain a ſufficient degree of coheſion, and at the ſame time are ſo friable, as readily to admit the roots and fibres of plants to extend themſelves in ſearch of nouriſhment.

Red and other coloured ſoils, generally contain a mixture of iron, copper, or lead, or ſome acid, which is poiſonous to vegetation. A proper application of quick lime (as hereafter directed, with an increaſe of quantity, as exigencies may require,) will effectually diſſolve and deſtroy thoſe pernicious particles, which, with the aſſiſtance of dung and ſufficient plowings, will render the moſt barren ſoils fertile.

It muſt be remarked, that according to the quantity of metallic particles impregnated with the ſoil, ſo in proportion ſhould the quantity of lime be accordingly applied.

Of MOORS and BOGGY SOILS.

MOORS and Bogs generally conſiſt of rotten trees, roots of weeds, and other half diſſolved vegetable ſubſtances, which having undergone ſome degree of putrefaction, are (ſimilar to all corrupted vegetables) turned into a black rich ſpungy kind of earth, that readily imbibes moiſture; and its ſpungineſs ariſes more or leſs, in proportion to the quantity of mud or ſlime carried over it by floods, which, with the acid contained in the ſtagnated moiſture, prevent a complete putrefaction.

The firſt thing neceſſary to be done, in order to improve Moors and Bogs, is to make proper incloſures, and drains of a ſufficient depth to carry off the ſtagnated waters; as their ſurface are a compoſition of moſs, fibrous roots, and coarſe graſs, they ſhould be pared (to ſuch depth as the roots penetrate) and burnt; ſuch aſhes abound with alkaline ſalts, which muſt be ſpread over the land. Where lime can conveniently be procured, eighty buſhels or more per acre, ſhould be laid on in piles of about half a buſhel to a perch, and as ſoon as ſlaked, it muſt be ſpread over the aſhes, (for the reaſons that will be aſſigned under the article wood aſhes,) which ſhould be plowed in, not more than four or five inches deep. By this method a fermentation and putrefaction will enſue, and after being expoſed a few weeks to the influences of the atmoſphere, the ſurface ſhould be well worked with loaded harrows; which will tear aſunder, and mix the lime and aſhes with the ſoil. The vegetable ſubſtances contained therein will ſoon be diſſolved, and converted into an exceeding rich and fertilizing manure.

The ſpecific gravity of lime and other manures are ſo great, as to be continually falling downwards, therefore it is eſſentially neceſſary that the firſt plowing ſhould not exceed the depth of four or five inches.

The ſecond plowing ſhould be to form the ridges, by which the aſhes and lime that were plowed in will be turned upwards, and after being thoroughly incorporated with the ſoil by harrowing, may be planted with potatoes, or ſuch other vegetables as may beſt ſuit the judicious huſbandman's inclination.

As Moory and Boggy lands are generally light and ſpungy, an addition of marle, clay, or loam, will add coheſion to their parts, and will, in a very ſhort time, moſt amply repay the Agriculturiſt.——Moory or Boggy lands, that do not produce five ſhillings per acre, may by this mode of management be made to produce forty ſhillings per acre, or more.

Of HEATHS and GOSSY GROUNDS.

HEATH and goſs when reduced into aſhes, are of the ſame properties as wood aſhes, which will hereafter be fully illuſtrated. If heathy or goſſy lands contain a ſufficient depth of mould, the roots ſhould be dug or plowed up, burnt, and ſpread over the ſurface with lime; and afterwards managed in the ſame manner as peaty or moory ſoils:—By a regular and proper cultivation, with an occaſional application of lime or other manures, the roots will be deſtroyed, and the Agriculturiſt ſoon benefited by his induſtry.

Of MANURES.

LIME.

QUICK or unſlaked lime contains no ſalts; when ſlaked, attracts oils, acids, and ſalts, from the earth and atmoſphere. Clayey and other ſoils, when firſt broken up or plowed, contain various mineral and poiſonous particles, weeds, worms, grubs, and inſects; all which lime diſſolves. The oils and ſalts abſorbed from the earth and atmoſphere, then become ſo intimately united with the animal and vegetable ſubſtances, already diſſolved by the lime, as to be converted into a ſoapy matter, by which they are rendered miſcible with water, and become the food of vegetables. Lime, by its expanſive force, opens, divides, and lightens a ſtiff ſoil, by which it is the eaſier pulverized; and gives a greater friability to ſtiff ſoils, than any other ſubſtance whatever. It is thus the roots of plants are permitted to extend themſelves.

Lime, when too frequently and injudiciouſly uſed, is a great impoveriſher of lands kept long under tillage. It exhauſts the earth by abſorbing its oily particles; hence the ſoil is rendered barren. The only remedy for ſuch miſconduct by which the ſoil can be reſtored, is a compoſt of rotten dung and earth, or ſcrapings of a lime-ſtone road and dung, twice turned and properly mixed; or a thick crop of buck-wheat, clover, vetches, or turnips plowed in, and rolled with a heavy roller: ſuch management will ſoon recruit the ſoil, and reſtore it to its proper vigour.

Lime, when properly and judiciouſly applied, ranks firſt amongſt the claſs of manures, particularly for all ſorts of ſtiff or loamy ſoils. The quantity beſt adapted, after the firſt breaking up or plowing of clayey and ſtiff lands, containing mineral and pernicious particles, ſhould be from one to two hundred buſhels per acre, (or in proportion to the quantity of poiſonous particles contained in the ground) laid on in piles of a proportionable quantity to a ſquare perch. As ſoon as ſlaked it ſhould be regularly ſpread on the fallow, and immediately plowed in.

After the ſurface has been ſufficiently expoſed to the atmoſphere, (which may be eaſily known by the crumbling of the ſoil,) it ſhould be well dragged, and the clods broken by a heavy roller. The next plowing ſhould be to form the ridges; the lime is thereby turned upon the ſurface, which ſhould be properly dragged and harrowed, (agreeable to my *New Mode* of culture, as hereafter deſcribed,) to prevent any incruſtation of the lime; and to be thoroughly incorporated with the ſoil.

The ſpecific gravity of lime is ſo great, as to be continually falling downwards; but by being thus mixed with the ſoil, (which I have before obſerved is lightened and divided by its expanſive force, and corrected by its cauſtic, abſorbent, and diſſolving powers) it then attracts oils and ſalts from the atmoſphere. A full confirmation of this aſſertion any perſon has in his power, by examining the nitrous particles on old walls; which particles are attracted ſolely by the lime.

When land has been long in tillage, it is eſſentially neceſſary to apply rotten dung with lime, not immediately mixed as a compoſt, but ſeperately; (*i. e.*) the lime to be firſt laid on, regularly ſpread as ſoon as ſlaked, properly dragged and incorporated with the ſoil; the dung to be ſpread after, and immediately plowed in. About eighty buſhels of lime, and from eight to ten cart loads of rotten dung, or ſixteen to twenty cart loads of dung and earth, twice turned, per acre. Such a quantity I deem to be the beſt proportion, for land that has been properly limed when firſt plowed, and is continued in conſtant tillage. Too much dung is very injurious to corn of all ſorts, by increaſing weeds and harbouring inſects; by promoting a too luxuriant growth of ſtraw, which draws the nouriſhment of the ſoil, and produces ſhort ſmall ears.

The objection I make to immediately mixing unſlaked lime with dung, is, that as unſlaked lime contains very cauſtic and abſorbing properties, it deſtroys the oleaginous and vegetative particles of the dung, ſimilar to that of fire in burning coal, which is reduced from its original, to a very different ſtate. Coal is well known to contain oleaginous, ſulphureous, bituminous, and other matters; after it has undergone the action of the fire what remains? Aſhes, or an abſorbent duſt; and but a very ſmall quantity in proportion to the coal.

By the mode I have pointed out of applying the lime and dung ſeparately, the ſoil is corrected by the lime, and enriched by the dung. When immediately plowed in, the oily particles of the dung are fixed, and prevented from being exhaled by the ſun, or volatilized. The dung by its fermentation, opens and divides the ſoil; the lime corrects the acidity (which is converted into a neutral ſalt,) or other noxious particles that may be contained in the earth or dung, or both. And after having remained ſome little time in this ſtate, the ground is again to be plowed and formed into ridges, dragged and harrowed as before directed, when only lime is uſed.

Of DUNG.

DUNG of all ſorts, contain ſalts and oils. The dung of horſes, hogs, and ſheep, is the hotteſt, and beſt adapted for ſtiff and cold ſoils.

Human ordure, the dung of poultry and of rabbits, are all extremely hot and rich; but are procured in ſuch ſmall quantities, as not to merit the huſbandman's particular attention. Hence ſhould be mixed with other dung or earth.

The dung of horned cattle is fat and cooling; therefore, moſt proper for light, ſandy, and gravelly lands.

When dung is carried into the field, where it is intended to be uſed, the higheſt head lands and banks ſhould be plowed or dug, and the dung depoſited thereon, with earth thrown over. The head land being plowed and pulveriſed, will readily abſorb the eſſence of the dung; and whatever quantity of the diſſolved ſalts and oils, that may be waſhed off by ſucceſſive heavy rains, will be carried over, and greatly enrich that part of the field adjoining to the dung. As the head lands are generally the higheſt and richeſt parts of the ground, the earth being mixed with the dung will make a good compoſt; and for every twenty loads of dung when ſpread on by itſelf, ten loads by being thus managed, will prove nearly, if not equally as advantageous as when dung only is laid on. Hence two acres of land, in lieu of one, or in proportion, may every year be manured; excluſive of the advantage of making the land even.

Of FARM YARDS and COMPOSTS.

SUCH parts of the farm yards where the dung is depoſited, ſhould be dug about two feet lower than the ſurface; by this method the urine and eſſence of the dung will be retained, and not liable to be carried off by rains. Pools or reſervoirs ſhould be made on the loweſt parts adjoining to the dung hills, to receive the ſuperfluous drainings, which ſhould be carried over the land in water carts, ſuch as are uſed to water the roads, and ſtreets in London.

When the yards are cleanſed of the dung, a ſtratum of about ſix inches deep of earth from banks, or uneven parts of fields or commons, ant-hills, ſcrapings of roads, ſweepings of filth ſurrounding the buildings, leaves of trees, fern, thiſtles and coarſe weeds in full ſap, before their ſeeds begin to ripen, and all other articles that can be converted into manure, ſhould be ſpread on the bottom of the hollow part of the yard; thoſe different articles will rot, and imbibe the eſſence of the dung laid on them. When convenient opportunities permit of depoſiting alternate ſtratums in this manner, an exceeding good compoſt is made at a ſmall expence, and the quantity of manure is greatly increaſed.

I muſt particularly obſerve that the refuſe ſtraw and other articles at the barn doors, as containing the ſeeds of different weeds, ſhould be mixed with dung, or into a ſeparate compoſt for paſture lands only. When ſuch manures are carried on arable lands, thoſe ſeeds will vegetate, and fill the ground with noxious weeds, which will be nouriſhed with that food intended for the ſupport of vegetables.

I have particularly mentioned the turning and mixing of dung only, or dung in a compoſt, to be performed twice. I entirely object to its being turned oftener, for the following reaſons ;—When turned twice, the compoſt will be ſufficiently incorporated; the fermentation and putrefaction will thereby be rendered complete, and converted into a proper aliment for plants. But when turned too often, or expoſed to the ſun and atmoſphere for any time, the oily and ſaline particles will be exhaled and volatilized, by the heat of the ſun and the atmoſphere. Hence, when uſed for tillage, the compoſt ſhould be immediately ſpread and plowed in; by which operation the volatile oil and ſalts will become fixed and united with the ſoil.

When compoſt is applied to paſture, the

latter part of October or beginning of November, is the beſt Seaſon. The heat of the ſun is then too weak for exhalation; the nouriſhment is waſhed into the ground by the autumnal rains; the remaining groſs parts left on the ſurface ſerve as a coat, to keep warm and protect the roots of graſs, from the chilling cold and froſt.

I have attentively obſerved, that piles of dung and earth, in alternate ſtratums, which lay unturned about eighteen months; the ſtraw, from nearly the top to the bottom, appeared as free from putrefaction as when firſt thrown out; the ſtratums of earth were ſo hardened, as to prevent the air and rain from penetrating, both which are eſſentially neceſſary to promote fermentation and putrefaction. The compoſt, by being well mixed and turned twice, became perfectly incorporated.

COAL ASHES and BURNT CLAY.

COAL aſhes and burnt clay are abſorbents, and act nearly ſimilar to lime, but not ſo powerfully.

SOAPER's ASHES.

SOAPER's aſhes are an excellent manure, ſuperior to moſt, but inferior to none, for clay, ſtiff cold ſoils, and loams. Soaper's aſhes are a compoſition of lime and wood aſhes, and of equal ſervice for arable and paſture lands; the quantity of from one hundred and ſixty, to two hundred buſhels per acre, is the moſt proper.

When applied to arable land, they ſhould be managed as lime; and the effects will continue for ſeveral crops. When applied for paſture, they deſtroy ſeveral ſorts of weeds, produce white clover, and an exceſſive ſweet herbage, which will continue ſeveral years. Soaper's aſhes being of a ſandy nature when dry, or the lumps minutely divided by the effects of rain and froſt, are rendered liable to be waſhed off the ground (particularly where there is a declivity,) by the heavy fall of autumnal and winter rains. Hence they ſhould be laid on in the months of January or February, when the ſucceeding rains will ſufficiently incorporate them with the land, which at that ſeaſon is looſened and lightened by the froſt.

Soaper's aſhes are an excellent addition to any compoſt dunghill, which will be greatly enriched by mixing one load of aſhes to every ten loads of compoſt.

Cattle of all ſorts prefer paſtures manured with ſoaper's aſhes to any other, which I impute to the effects of the alkaline ſalts which they contain. Horſes and horned cattle may be ſafely permitted, and will greedily eat the crops that ſucceed the manuring.

Sheep are liable to a diſorder called the rot, from feeding on any newly manured, luxuriant herbage, the greateſt care ſhould be taken not to let them be admitted upon ſuch land, until the ſecond year after it is manured.

When too great a quantity of ſoaper's aſhes are applied at one time, the graſs will be burnt up; and the ſucceeding crop, if not entirely deſtroyed, will be greatly injured. Hence it is more prudent to manure with one hundred and ſixty buſhels per acre in one ſeaſon, and the ſame quantity two or three years after; than to lay on three hundred or more buſhels at one manuring. By the firſt mode the effects will continue, and viſibly appear for fifteen years, on lands that are naturally dry, or that have been previouſly drained.

Brandy, (as one of the numerous and various articles uſed by man,) when ſeaſonably and moderately applied, is very ſalutary; but when uſed to exceſs becomes very hurtful. Hence is ſimilar to the immoderate uſe of ſoaper's aſhes, or any other manure.

Thiſtles and other luxuriant weeds, cut cloſe to the ground, are deſtroyed by ſcattering ſoaper's aſhes over the bleeding ſtumps, immediately after they are cut.

Of WOOD ASHES.

WOOD aſhes contain fixed alkaline ſalts and abſorbent earth, attract moiſture and inflammable matter from the atmoſphere, and keep the earth in an open ſtate. Lime deprives wood aſhes and other alkalies of their fixed air, increaſes their power for the purpoſes of a cauſtic, and enables them more readily to diſſolve oils and mucilaginous particles.

Wood and all other vegetable aſhes, from whatever vegetables they have been produced, are of one and the ſame quality for the purpoſes of agriculture; and ſhould (when conveniency permits) be kept perfectly dry till they are uſed. When expoſed to the rains, the ſalts are waſhed out, and of courſe the aſhes are not ſo efficacious.

Of SOOT.

SOOT is a compoſition of fixed and volatile alkaline ſalts, oils, and a ſmall quantity of calcarious earth, ariſing from the fuel with the ſmoak; or may be rather deemed the ſmoak itſelf, gathered and fixed on the ſide of chimnies.

Soot is a moſt excellent top dreſſing for grain of all ſorts, and for cold ſtiff paſtures; it deſtroys moſs and kills inſects. When it can be procured on reaſonable terms, it is a cheap and effectual manure; but ſhould never be applied in a dry ſeaſon, as it will injure the blades of corn or graſs. The moſt proper quantity is from twenty-five to thirty buſhels per acre, ſowed early in the ſpring, before rains, which waſh it off the leaves of plants into the ground; and its ſudden effects will ſoon be perceived, by the deep green and luxuriant growth of the crops.

Of COMMON SALT.

COMMON ſalt produced from ſea water and ſprings, is originally the ſame; differs in ſtrength and ſome other qualities, according to the operation by which it is made; the quicker the liquor is evaporated, the weaker is the ſalt: When the liquor is evaporated over a ſtrong fire, part of the ſtrength or acid of the ſalt is raiſed with it. Hence, the more gentle the proceſs, the ſtronger is the ſalt.

Salt is not beneficial to vegetation; when decompoſed by being mixed with a proper compoſt, it may then aſſiſt to promote vegetation; but the advantages ariſing therefrom to farmers in general, cannot be adequate to the expence.

Of SEA SAND.

SEA ſand is a good manure for all ſoils, particularly ſands and light ſandy lands. When carried immediately from ſuch parts of the ſhores as are daily overflowed by the tides, it is ſaturated with ſtrong ſalts of an alkaline nature, and putrid matters, which the ſea waters contain. It adds tenacity to ſuch light ſoils, by the putrid ſaline particles attracting and retaining moiſture, which having undergone no operation of the fire, conveys its original properties in their natural ſtate. Hence it differs materially from common ſalt.

Of SEA WEEDS.

SEA weeds contain alkaline ſalts and mucilage; they ſhould never be applied without being firſt mixed with lime and earth, or with earth, to ferment and putrify. When burnt they yield an excellent manure, called kelp, containing vitrifiable earth, and a very ſtrong alkali, ſoluble in water. It acts as vegetable aſhes.

Weeds and offals of a garden when burnt, produce alkaline ſalt and abſorbent earth. If not burnt, ſhould be mixed with the compoſt dunghill. When the ſeeds of weeds are formed, it is eſſentially neceſſary the weeds ſhould be burnt, to prevent their ſeeds from ripening, and being conveyed into the ground with the manure. As couch and ſome other weeds vegetate at every joint or knot, they likewiſe ſhould be burnt.

Of SHELLS of SEA FISH.

SHELLS of ſea fiſh, and all others, are compoſed of calcarious earth and ſalts. When applied in their natural ſtate, continue a long time without diſſolving. When burnt, are converted into lime.

Of CHALK.

CHALK is an abſorbent earth, containing neither oils nor ſalts; but when incorporated with the earth, it attracts acids, oils, and ſalts.

Of MARLE.

MARLE is compoſed of lime, clay, and ſand; is increaſed in value according to the quantity of lime it contains, and is beſt adapted for ſands and light ſoils. The quantity applied ſhould be in proportion to the lightneſs of the land.

Of BRICK and LIME RUBBISH.

BRICK and lime rubbiſh are good manures for cold arable lands; are abſorbents, and lighten the ſoil.

Of SAW DUST and TANNER's BARK.

SAW duſt, Tanner's bark, and rotten leaves, are beſt for the compoſt dunghill, and good for all ſoils.

Of ANT HILLS.

ANTS are evidently known to be very injurious to lands, particularly paſtures. Obſervations inſtruct me that they multiply and increaſe moſt in cold clayey, or ſuch other ſoils as contain the greateſt acidity. The hills they raiſe produce but a very ſmall quantity of ſuch coarſe graſs as no animal chooſe to eat. The longer theſe hills are permitted to remain on the ſoil, the more they are extended over the ſurface, and increaſed in number. Hence, the ground they occupy is ſo much land loſt to the farmer; and on lands that are mowed, theſe hills and hillocks quickly blunt the edge of the mower's ſcythe. The heavy falls of autumnal rains that ſaturate the earth, oblige theſe ſagacious, but injurious inſects to aſcend from under the ſurface of the ground, into a higher ſituation in their manſions, which are moſt conveniently conſtructed for their reſidence and defence from rains. The vernal heat of the ſun, does alſo influence them to occupy their upper apartments; theſe are the ſeaſons beſt adapted for their deſtruction. In the months of November or December, when the earth is frequently filled with water, their hills ſhould be pared off, rather lower than the ſurface, and immediately carried to the dunghill, or mixed with lime or ſoaper's aſhes, where the eggs and inſects will be converted into a rich manure. Should any of the ants remain under the ground from whence the hills were taken, their paſſages will be ſo open and expoſed, as readily to admit the rains and froſts; when a ſmall quantity of ſoaper's aſhes, ſoot, or lime freſh ſlaked, ſowed over, will effectually deſtroy them, and ſoon produce a ſweet herbage. A woman or boy can cover a great quantity of ſuch pared ground in a ſhort time, and at a very inconſiderable expence.

In the months of April or May, as the heat increaſes, theſe inſects are alſo influenced to aſcend their upper apartments, for to enjoy the ſun's enlivening powers; at ſuch ſeaſons they and their hills ſhould be cut, carried off, and managed as before directed.

rected. The bare ſpots ſhould be ſowed with graſs ſeeds and white clover, raked in, which will ſoon vegetate.

Three advantages reſult from ſuch conduct, the land is made even, the inſects are deſtroyed, and a rich addition, far ſuperior to common earth, is procured for the compoſt dunghill.

I entirely explode the methods generally made uſe of in Gloceſterſhire, and many other parts; which are the quartering or paring off the tops of the hills, digging out the inſects and eggs, which are ſcattered over the ground, and the ſurface of the hills replaced on the parts from whence they were cut. By ſuch modes, in lieu of levelling the lands, hollows or holes remain on ſuch parts of the ground, and the ants are not deſtroyed, but diſperſed over the ſoil, to form new colonies, more numerous than before.

Of the MUD of POOLS, &c.

MUD of pools, ditches, ponds, and rivers, is compoſed of the waſhings of high roads, the dung of geeſe and ducks, dung and urine of cattle, dead animals, and rotten vegetables, all which putrify and become a good manure. It ſhould be mixed with dung, ſoaper's aſhes, or with lime.

Of WOOLLEN RAGS, &c.

WOOLLEN rags, cuttings of leather, particularly the refuſe of ſkinners and tanner's yards; with hair, and bones ground or powdered; are exceeding good manures, containing mucilage, oils, and alkaline ſalts.

Of DEAD ANIMALS.

DEAD animals ſhould be buried in a dunghill, where they will corrupt, putrify, and greatly enrich it; they contain oils and ſalts.

Of URINE.

HUMAN and animal urine are compoſed of water, oil, and ſalt. Human urine ſhould be carefully preſerved in caſks or tubs, and if not uſed by itſelf as a manure, ſhould be thrown on the dunghill.

All kinds of urine, when recently applied, are very acrid, and rather hurtful to vegetation. When ſtale, their acrid properties are corrected by fermentation, and then they contribute greatly to fertilization.

Stale urine and barton draining, are greatly preferable to dung for fruit trees, as penetrating better to their roots, and not harbouring inſects; whereas dung ſecretes worms and inſects, that are conveyed to the roots of the trees with the dung, which mixed with the mould, undergo a ſecond fermentation; and thereby the worms and inſects acquire ſuch ſtrength, as to make the tender roots and fibres of the trees part of their food. Hence trees being deprived of great part of their grand reſources, (which are conveyed to them through the pores or mouths of every root and fibre,) become diſeaſed, and frequently die.

Another diſadvantage attends the application of dung and dead animals to the roots of trees; theſe manures are very improper, as they harbour worms and inſects, that attract moles and other vermin, which do much injury, by breaking the roots and tender fibres of the plants, and by making hollow paſſages, which admit the cold air and froſts in winter, and the ſcorching heat in ſummer. Hence trees and plants become ſickly, and are rendered incapable of producing luxuriant crops.

When trees are manured with dung, the wheeling or carrying it greatly injures the walks, and is attended with much trouble and expence. Whereas ſtale urine and barton drainings contain the real eſſence of the dung, without ſupplying food for the increaſe and nouriſhment of worms and inſects; and the work is executed with very little trouble and expence.

Human urine is the richeſt, as containing more ſalts and oil than any other. As great quantities may be collected in cities and towns, it ſhould be kept in caſks to ferment; if mixed when ſtale with piles of earth, it will form an excellent compoſt, far ſuperior to dung, for gardens and other ground. Stale urine, applied by watering pots, over the trenched garden grounds after being levelled in the ſpring, will kill worms and inſects, and prove an exceeding rich manure, entirely free from weeds. Gardeners in particular, would very ſoon experience the greateſt advantages by adopting ſuch mode; and immenſe quantities might be ſaved of a moſt valuable manure, which is thrown away and deemed as uſeleſs.

Of SOAP SUDS.

SOAP is compoſed of vegetable or animal oil, alkaline ſalts, and lime, by which their original textures are altered and become ſo combined, as to be eaſily rendered miſcible with water. Hence ſoap ſuds are converted into an excellent manure for fruit trees and flowers.

Of MALT DUST.

MALT duſt is an exceeding good top-dreſſing for corn and meadows in the ſpring. Dung and other manures plowed in, looſen and divide the ſoil, and are beneficial to ſucceeding crops. Whereas top-dreſſing (excepting the alkaline manure) principally nouriſh the plants, and ſupply food for thoſe crops only on which they are laid, without looſening or dividing the ſoils, or being beneficial to ſucceeding ones. From twenty to forty buſhels per acre, (according to the poverty or richneſs of the ſoil) is the moſt advantageous. When too great a quantity of malt duſt is applied to corn, the ſtraw grows ſo luxuriant, as to be beaten down and laid by high winds and heavy rains.

Of a new, cheap, and effectual Alkaline MANURE.

LANDS adjoining to cities and large towns may be manured on very reaſonable terms; and according to the diſtance, ſo in proportion is the expence of carriage increaſed.

Lands ſituated in the interior parts of the country, are in general manured only with the dung ariſing from the cattle, and ſheep folded on the grounds; the quantities thus obtained, are very inſufficient for the purpoſes of proſecuting an advantageous cultivation.

All or moſt countries produce either wood, goſs or furze, heath, or peat frequently called turf, which are uſed for firing; their aſhes are thrown (from a want of knowing their real value) into ſome open place, where they are expoſed to rains, which waſh away their ſalts and fertilizing properties. The great advantages of manures, particularly where the diſtance is too far to procure them from cities or towns, muſt be too obvious to the diſcerning Agriculturiſt, to require any comment.

The alkaline and new manure, which I have experienced to be inferior to none, I make as often as I can procure materials, in the following manner, viz. Having collected from the ſides of ditches and from commons, a quantity of rubbiſh wood, briers, &c. ſtems and roots of weeds, ſtalks of beans, and garden offals, which are burnt and the aſhes ſifted; ſuch cinders as are not thoroughly conſumed, undergo the ſecond operation of the fire, are again ſifted, and immediately carried into a houſe to prevent the bad effects of rain; and to every four buſhels of the aſhes, or in proportion, I add one buſhel of quick lime, on which is thrown as much ſtale urine or barton draining, as will thoroughly ſlake it, when the whole is turned and mixed as often as is neceſſary, ſo that the lime and aſhes may be compleatly incorporated.

The aſhes of all vegetables are vitrifiable, and frequently found to contain metallic particles. Quick or freſh burnt lime is freed from fixed air, its corroſive and acrimonious properties are ſo great, as to decompoſe metallic particles, as alſo to deprive alkalies of their fixed air, and diſunite their texture; by which their powers are ſo much encreaſed, as to be the more readily enabled to diſſolve oils, &c. for the purpoſe of making ſoap. Hence in a ſimilar manner, they unite with and diſſolve the oleaginous particles in the earth, by which the oils and ſalts are rendered miſcible with water, and thereby converted into a moſt nutritive food for vegetables. When lime is expoſed to the air (even in a houſe) it will abſorb moiſture, fall into a powder, attract fixed air, and by degrees loſe its corroſive and acrimonious powers. Aſhes alſo attract moiſture, &c. Hence, if the alkaline manure is not immediately uſed, it ſhould be carried into a loft or ſome

dry

place, well covered and kept as cloſe as poſſible from the air, by which its virtues will be retained. If uſed as a top-dreſſing for wheat, eight to ten buſhels per acre, ſowed in the months of November or December, when the manure will be ſoon waſhed into the earth, will nouriſh and keep warm the roots of the plants, kill inſects, and greatly fertilize the land for that and ſucceeding crops.

When applied to barley, it ſhould be ſowed very early in the ſeaſon, for reaſons already given under the ſection of ſoot.

When applied for paſtures, the land ſhould be firſt harrowed with fine harrows in the month of January or February, and from eight to twelve buſhels per acre, regularly ſowed over. The harrows will looſen the ſoil, admit the air and manure to the roots of the graſs; their effects will ſoon become viſible, and continue for ſome years.

When applied for a compoſt, twenty buſhels or more (according to the nature of the ſoil,) may be mixed and thoroughly incorporated with ſixty buſhels of earth to an acre, and applied in the ſame manner as lime.

Peat or turf aſhes mixed with lime, act as wood aſhes and lime; but as peat aſhes contain leſs ſalts, a greater quantity ſhould be applied.

Sea ſhores produce great quantities of weeds, which when burnt, become a ſolid ſubſtance called kelp, containing ſtrong alkaline ſalts. Such aſhes pulveriſed, ſifted, and mixed with lime, in the ſame manner as wood aſhes, muſt prove equally as efficacious. Opportunity has not, as yet, enabled me to make experiments on kelp, therefore I cannot aſcertain the beſt proportion to be mixed with lime; but reaſon dictates, that as kelp contains a much greater proportion of alkaline ſalts than the ſame weight of wood aſhes, ſo in proportion a leſs quantity will ſuffice; which experiment any perſon living near the ſea, has in his power to make.

As the properties of kelp are very corroſive, I recommend its being firſt mixed with lime, then with earth in a compoſt, in preference to its being applied alone, and ſhould be kept in a dry place ſome weeks before it is uſed.

When wood, weeds, &c. are burnt in the open air, the volatile ſalts, oils, and part of the calcareous earth, aſcend in the form of ſmoak into the atmoſphere.

Where large quantities of rubbiſh wood, weeds, &c. can be procured, a ſmall building

ing ſixteen feet long, twelve feet high, and twelve feet broad, or of any other ſize, covered with an arch or dome, with a high and narrow chimney, might be erected at a very inconſiderable expence. The rubbiſh wood, &c. ſhould be burnt therein, the volatile particles and calcarious earth would be preſerved on the dome and walls in the form of ſoot, the aſhes would be kept dry, and the Agriculturiſt would in a ſhort time be fully repaid ſuch expences.

Of NATURAL PHILOSOPHY.

NATURAL Philoſophy is the knowledge or ſtudy of natural productions, founded on reaſon and experience. By ſtudying the qualities of natural bodies, in relation to their generation, motion, or other properties, the wonderful works of the creation are diſcovered to our view, that we may with chearful and divine contemplation, ſenſibly feel and gratefully acknowledge the myſterious works of providence.

God beſtowed upon man the earth, that he might employ his time, by labour and underſtanding, in repleniſhing and ſubduing it.

By labour, to cultivate the ground; ſuch employment makes him ſtrong, active, and healthy.

By underſtanding, to ſtudy the moſt beneficial methods of repleniſhing, and applying ſuch manures as are moſt effectual for ſubduing and correcting its coheſive and injurious particles; that he may, by his induſtry and knowledge, be beſt enabled to ſupply the wants of nature.

Providence moſt wonderfully aſſiſts the induſtry of man, by celeſtial and atmoſpherical influences, which greatly tend to enrich the earth, and to promote vegetation.

Of the SUN.

THE Sun is the principal ſource of heat as well as light, without which, all bodies would become rigid, lifeleſs, and fixed. Hence, animalization and vegetation are promoted, and the ocean and atmoſphere continue in a fluid ſtate.

Heat contributes materially to promote the growth of plants; vibrates the parts of bodies; excites and promotes a motion in the fluids; reſolves the watry and oily particles of the earth into vapour; rarifies the juices of vegetables; exhales the putrid, volatilized, ſulphurious, ſaline, and inflammable particles from dunghills, other corrupted bodies, and from ſmoak. Part is abſorbed by vegetables, which adds to their increaſe: the remainder aſcend and float in the atmoſphere, where being combined,

bined, are formed into a ſaline ſubtile oil, which by the ſummer ſhowers and dews, are converted into nutriment, returned into the earth, and abſorbed by the leaves and roots of plants.

The life and growth of animals and vegetables, depend on a certain degree of heat, which every year confirms. As the heat decreaſes in autumn, ſo in proportion vegetables loſe their verdure. And as the ſun's enlivening powers return in the ſucceeding ſpring, every plant will earlier or later reſuſcitate and accordingly grow to maturity.

Exceſſive heat without moiſture, is injurious to vegetation; as more nouriſhment is exhaled from the earth and plants, than is returned by that condenſed vapour which falls in the form of dew.

By a defect of heat, the circulation of

the ſap becomes languid and ceaſe; and according to the continuation of the cold drying winds, (without the intervention of rain or dew) ſo proportionably is the perſpiration and circulation or motion of the juices ſtopped, in the tender bloſſoms, leaves, and branches; the perſpiring matter thereby adhering to the external parts, are converted into a mucilage that harbours inſects, (which are the *Effects*, but not the *Cauſe* of BLIGHTS,) ſimilar to all corrupted animal bodies, which naturally ſecrete worms.

It frequently happens that one part of a tree is ſuddenly ſcorched and ſhriveled, by a ſharp hoary froſt or cold wind, which ſtops the weak motion of its juices; while the other part appears healthy and in full verdure. Such effects ariſe from inward weakneſs, the want of ſufficient moiſture or nouriſhment, or from ſome bad quality in the ſoil or ſtock.

Soap Suds, ſtale urine, or barton drainings, applied to the roots of trees after the earth has been dug or looſened, inſtead of ſecreting and nouriſhing, deſtroy worms and inſects; keep the roots of trees warm in winter, and by their ſaline and oily particles, attract and retain moiſture in ſummer. Hence, are the moſt effectual preſervatives againſt blights, and other diſeaſes. In wet ſeaſons thoſe manures may be freely uſed, as the rains will ſufficiently correct them when too ſtrong; but in dry weather they ſhould be properly diluted with water.

Of FROST.

FROST is the moſt ſevere effect of cold, but a great fertilizer of land, particularly all ſtiff and clayey ſoils. It anſwers ſeveral purpoſes; it locks up the ſurface of the earth, prevents the carrying off that ſubſtance neceſſary for vegetation, checks the growth of weeds, prevents the hatching of inſects and deſtroys them, lightens the earth, expands the moiſture, and breaks down the texture of the ſoil into the moſt minute particles.

White froſt is no more than dew frozen, which does not injure vegetables materially.

Of HAIL.

HAIL is drops of rain frozen in their paſſage thro' the atmoſphere. The greater the height they deſcend from, the greater is the reſiſtance they meet with from the air, the more globular and the ſmaller is the hail. Hence, vice verſâ, the leſs the height of their deſcent, the leſs is the reſiſtance they meet with in the air, of courſe the leſs globular and the larger is the hail. It is very hurtful to vegetation, by beating the farina or bloſſoms off the corn and trees.

Of SNOW.

SNOW is a meteor engendered in the air by moiſture and cold; contains no nitre nor any other ſalts, leaves nothing that chryſtalizes after diſſolution; but contains inflammable matter, and makes the common air more noxious and unwholeſome than before.

Snow fertilizes the ground, by preventing the eſcape of what nouriſhes plants, protects corn and other vegetables from the intenſer cold air and piercing winds, and keeps their roots warm.

Of LIGHTNING.

LIGHTNING is generally ſuppoſed to be a mixture of ſulphureous and nitrous effluvia, which ferment, kindle, and occaſion thoſe exploſions and vivid flames of fire, which we call thunder and lightning; and is in the hand of Providence, in ſome reſpect, ſimilar to what electricity is in ours.

Lightning does much more good than hurt to vegetation, it frees the atmoſphere from ſulphureous and other noxious particles, and produces cold. Hence, the watry vapours floating in the air are condenſed,

denſed, and deſcend in the form of rain, which greatly fertilize the land.

Of DEW.

DEW is a compound of moiſture, oily, ſaline, and volatile particles, exhaled by the great heat of the ſun from the ſea, rivers, ſtanding waters, marſhy lands, the earth, dunghills, and other putrid matters; all which are attracted by the wonderful power of the ſolar rays, and carried into the atmoſphere, where they float, are intimately united, and kept in agitation by the heat of the ſun, and become inviſible. But when the ſolar heat begins to remit, and as the air cools, the watry compound particles are condenſed, and fall upon the earth and leaves of vegetables. The ſtronger the heat of the ſun, the greater is the exhalation, and fall of dew at night. As the ſun aſcends above the horizon in the ſummer, the exhalation, particularly of ſtanding waters and marſhy lands, is extremely viſible.

In the drieſt and warmeſt ſeaſons, when the earth is parched and dried up, then Providence moſt wonderfully aſſiſts and promotes vegetation, by the fall of dews on the leaves of trees and vegetables. As the heat of the ſun increaſes, it excites and promotes a motion in the juices; the leaves imbibe the fertile pearly drops, and convey them through the veſſels by which vegetables are nouriſhed.

Of CLOUDS.

CLOUDS are a collection of vapours exhaled from the ſea, other waters, and from the land, by the ſun or ſubterraneous heat, or both, which when exhaled are too ſmall to be perceived; but when they aſcend into that region of the atmoſphere of the ſame ſpecifick levity, there they float, are driven together by the agitation of the winds, condenſed by the cold, and rendered opake by the union of their parts. Hence they viſibly appear in the form of clouds, which being heavier than the air, of courſe fall thro' it; and according to the height they deſcend from, and the reſiſtance they meet with from the atmoſphere, are broken and divided into proportionably ſmall drops, called rain.

Of RAIN.

RAIN is a precipitated cloud, broken and divided into innumerable drops. The greater the height they deſcend from, the greater is the reſiſtance they meet with from the air, the more are they divided, and leſſer are the drops of rain. Hence, vice verſâ, the leſs the height of their deſcent, the leſſer is the reſiſtance they meet with in the air, of courſe the larger are the drops of rain.

Vegetables cannot grow without water. Rain promotes vegetation, by furniſhing ſalts and oils from the atmoſphere, by diſſolving and uniting the oily and ſaline particles in the earth, by expanding the imbibing veſſels, by attennuating the glutinous ſubſtances, by promoting the inteſtine motion of the juices, by looſening the earth that the roots of plants may enjoy acceſs of air, and be better enabled to extend themſelves in ſearch of thoſe nutritive particles, conveyed to them by means of heat and that moſt uſeful watry menſtruum.

Exceſs of rain is hurtful to vegetation, particularly when waters remain any conſiderable time on the ground, which leſſen the warmth in the earth, and thereby prevent vegetation; or deſtroy the roots of plants, and renders ſuch places barren; or produce ſuch rank unwholſome weeds as are nouriſhed by ſtagnated waters, which become putrid by the heat of the ſun.

Too much moiſture yields a thin and vitiated food, prevents the acceſs of air to the roots of plants, impedes their natural growth, and prevents their ſeeds from being perfected.

If heavy rains fall when the plants are in bloom, their farina is waſhed off, and conſequently there can be no impregnation. Hence wet ſeaſons produce the ſmalleſt crops.

The want of rain is alſo hurtful to vegetation. Heat diſſipates the moiſture in the earth, which becomes too dry. Hence it is baked and rent by the ſcorching rays of the ſun, which deſtroy the roots of plants; or ſo harden the earth, as to prevent the fibres from extending themſelves in ſearch of food.

Of AIR.

AIR is an inviſible thin elaſtic vapour, imperceptible to all our ſenſes, except that of feeling.

The colder the weather the more is the air condenſed, whereby the heat of fires are more confined, and become ſtronger in winter than in ſummer.

When water is converted into vapour, by diſtillation or exhalation, the water becomes lighter than the air. Hence watry vapours are raiſed to a conſiderable height, and float in the atmoſphere; where its weight, denſity, and preſſure, is leſs than near the ſurface of the earth.

Moiſt vapours leſſen the elaſticity of the air, becauſe the force of repulſion in the particles of watry vapours, is leſs than in the particles of air.

A moiſt atmoſphere is heavier than a dry and clear atmoſphere, in proportion to the quantity of ſuſpended watry particles; and according to its component parts its weight varies, which barometers diſcover.

The elaſticity of air is increaſed by heat, and decreaſed by cold. Hence appears the uſe of thermometers, which indicate the various degrees of both.

Air is abſolutely neceſſary for the ſupport of animal and vegetable life; without it there could be no exiſtence, which experiments with air-pumps ſufficiently demonſtrate. No ſeed can vegetate, nor vegetable grow in any place deprived of air.

Freſh air is impregnated with a particular vivifying ſpirit, eſſentially neceſſary to the preſervation of animal life.

Every time the air paſſes out of the lungs, part of the vivifying ſpirit is either deſtroyed or left behind. Hence animals die when confined in noxious air, as well as from want of air.

Air is changed by the corruption and putrefaction of the vivifying ſpirit; as the properties of things putrefied are different from the properties they contained before putrefaction, ſo in proportion is the health of animals affected. Hence ariſe epidemical diſeaſes amongſt the inhabitants and animals of ſuch countries as are marſhy, and are ſurrounded or interſected with ſtagnated waters, which of courſe putrefy and deſtroy the vivifying ſpirit in that air.

The different effluvias diffuſed thro' the air, produce a variety of different effects. In all large cities the air abounds with ſulphureous, acrid, and corroſive particles, which ruſt metals ſooner than in the country; and near mines of copper, its effects are ſo great, as to diſcolour ſilver and braſs.

Air not only acts upon all bodies by its common properties of weight and elaſticity, but alſo by the peculiar qualities of the ingredients whereof it is compoſed, greatly promotes vegetation; for the more vegetables enjoy the free acceſs of air, (not only to their leaves, ſtalks, and branches, but alſo to their roots) the more they grow and thrive. Such is the vivifying power of air, that it was conſidered by the ancient philoſophers as the firſt principle of all things.

As the learned and ingenious Dr. HUNTER, of York, firſt made thoſe important and intereſting diſcoveries, relative to the putrid and noxious particles of the air being conſumed by the vegetable creation, and which were publiſhed in the year 1769 and 70. I will beg leave to preſent the reader with ſuch extracts as are neceſſary for my preſent ſubject.

"It is pleaſing to obſerve, how the diſſo-
" lution of one body, is neceſſary for the
" life and increaſe of another. All nature
" is in motion. In conſequence of the
" putrid fermentation that is every where
" carried on, a quantity of vegetable nu-
" triment aſcends into the atmoſphere.—
" Summer ſhowers return much of it again;
" but part falls into the ſea and is loſt:
" to this we may add the animal and ve-
" getable ſubſtances conſumed on board of
" ſhips, all of which are buried in the
" ocean. The induſtry of man reſtores
" them to the earth; and we may preſume
" that the fiſh taken from the ſea, leave a
" balance in favor of mankind. Thus Pro-
" vidence,

" vidence, with the moſt conſummate wiſ-
" dom, keeps up the neceſſary rotation of
" things."

Dr. Hunter's Georgical Eſſays, Vol. II. P. 135.

" Hitherto I have conſidered plants as " nouriſhed by their roots. I ſhall now " take a view of them as nouriſhed by their " leaves. An attention to this part of the " vegetable ſyſtem, is eſſentially neceſſary " to the rational farmer. Vegetables that " have a ſucculent leaf, ſuch as vetches, " peas, beans, and buck wheat, draw a " great part of their nouriſhment from " the air, and on that account, impoveriſh " the ſoil leſs than wheat, oats, barley, or " rye, the leaves of which are of a firmer " texture. Rape and hemp are oil-bearing " plants, and conſequently impoveriſhers " of the ſoil; but the former leſs ſo than " the latter, owing to the great ſucculency " of its leaf. The leaves of all kinds of " grain are ſucculent for a time; during

“ which period the plants take little
“ from the earth; but as ſoon as the ear
“ begins to be formed, they loſe their ſoft-
“ neſs, and diminiſh in their attractive
“ power. The radical fibres are then
“ more vigorouſly employed in extracting
“ the oily particles of the earth, for the
“ nouriſhment of the ſeed. Such, I ap-
“ prehend, is the courſe of nature.”

Ibid. Vol. I. P. 57.

“ In order that we may have a diſtinct
“ view of the motion of the ſap, it will
“ be neceſſary to reflect, that the root,
“ ſtem, branches, and leaves are conſtruct-
“ ed in the ſame manner. Sallows, wil-
“ lows, vines, and moſt ſhrubs, will grow
“ in an inverted ſtate, with their tops
“ downwards in the earth. Dr. BRAD-
“ LEY deſcribes the manner of inverting a
“ young cherry tree, the roots of which
“ will put forth leaves, and the branches
“ become roots. Hence it is obvious that
“ the

" the nutritive matter may be conveyed as
" well by the leaves as the roots, their vaſ-
" cular ſtructure being the very ſame."

Ibid. Vol. I. P. 168.

" Air is to be found in every portion of
" earth; and as it always contains a ſolution
" of the volatile parts of animal and vegeta-
" ble ſubſtances, we ſhould be careful to
" keep our ſtiff ſoils as open as poſſible to
" its influence. It paſſes, both in its ac-
" tive and fixed ſtate, into the abſorbent
" veſſels of the root, and, mixing with the
" juices of the plant, circulates through
" every part. Dr. HALES, in his ſtatical
" experiments upon the vine, diſcovered it
" aſcending with the ſap in the bleeding
" ſeaſon."

Ibid. Vol. I. P. 189.

In the year 1773, the ingenious and indefatigable Dr. PRIESTLY, preſented to the

Royal Society, his experiments on the different kinds of air, which clearly proves that putrid air ariſing from dunghills, and that the perſpiration of animals, are not only abſorbed by vegetables, but alſo add to their increaſe. As thoſe experiments are of too intereſting a nature to be paſſed over unnoticed, for the benefit of thoſe who have not had an opportunity of ſeeing the original, I ſhall here tranſcribe part, referring the curious to the learned Doctor's publication.

" When air has been freſhly and ſtrongly
" tainted with putrefaction, ſo as to ſmell
" through the water, ſprigs of mint have
" preſently died, upon being put into it,
" their leaves turning black; but if they
" do not die preſently, they thrive in a moſt
" ſurpriſing manner. In no other circum-
" ſtances have I ever ſeen vegetation ſo vi-
" gorous as in this kind of air, which is
" immediately fatal to animal life. Though
" theſe

" theſe plants have been crowded in jars filled with this air, every leaf has been full " of life; freſh ſhoots have branched out " in various directions, and have grown " much faſter than other ſimilar plants, " growing in the ſame expoſure in common air. This obſervation led me to " conclude, that plants, inſtead of affecting " the air in the ſame manner with animal " reſpiration, reverſe the effects of breathing, and tend to keep the atmoſphere " ſweet and wholeſome, when it is become " noxious, in conſequence of animals either living and breathing, or dying and " putrefying in it.

" In order to aſcertain this, I took a " quantity of air, made thoroughly noxious, " by mice breathing and dying in it, and " divided it into two parts; one of which " I put into a phial immerſed in water, " and to the other (which was contained in " a glaſs jar, ſtanding in water) I put a

" ſprig of mint. This was about the beginning of Auguſt 1771, and after eight or nine days, I found that a mouſe lived perfectly well in that part of the air, in which the ſprig of mint had grown, but died the moment it was put into the other part of the ſame original quantity of air; and which I had kept in the very ſame expoſure, but without any plant growing in it.—This experiment I have ſeveral times repeated, ſometimes uſing air in which animals had breathed and died; ſometimes uſing air tainted with vegetable or animal putrefactions, and generally with the ſame ſucceſs."

Dr. Prieſtley's Experiments and Obſervations on different Kinds of Air. Page 86.

On the IMPROVEMENT
OF
WET LANDS.

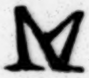
THE firſt and principal improvement of wet land is draining; without which, the greateſt quantity of the beſt manure will prove ineffectual. Coarſe graſs, ruſhes, horſe-mints, and other noxious weeds, are the general productions of lands overcharged with moiſture, proceeding from the water being retained by a ſtiff impervious clay, or from cold hungry ſprings, which are frequently loaded with minerals and acids; and from want of proper drains the ſtagnated waters corrupt the natural nouriſhment, ſo eſſentially neceſſary for producing ſweet herbage: but when the cauſe is removed, the effects will ceaſe. Thoſe luxuriant, noxious weeds, being deprived of their nouriſhment, of courſe die, and ſweet wholeſome herbage naturally ſucceed, without manure.

The greateſt attention ſhould be paid to the ſituation and declivity of the ground; the ditches at the loweſt part of the land ſhould be firſt opened of a ſufficient depth and ſize, (according to the nature of the ſoil,) at leaſt three feet perpendicularly deep, two feet wide at the bottom, and four feet wide at the top, gradually increaſing from the bottom to the ſurface; which ſlope will prevent the ſides from falling in with rains or froſts.

In a ſtone-braſh clay my main or leading drains are made, (according to their declivity,)

clivity,) from twenty to twenty-four inches deep, nine inches wide at bottom, and from fifteen to eighteen inches broad on the ſurface; extending thro' the moſt hollow, and from the loweſt to the higheſt parts of the land. The branches, or ſmaller drains are from twenty to forty, or fifty feet a-part, (in proportion to the ſprings and wetneſs of the ſoil,) cut a-croſs the ground with a hanging level, ſufficient to convey the water into the large drains; the ſmall drains are made narrower, and more ſhallow, than the main drains.

Stones are the moſt effectual for this purpoſe: when the work is properly executed it will laſt for ever. The beſt method I have experienced is, to place flat ſtones, ſtanding on the bottom as perpendicular as the ſides of the drains will admit, with other flat ſtones on the oppoſite ſide, placed with the top part to reſt againſt the upright ſtones, in the form of Λ

Should this cavity be inſufficient for the current of water, another flat ſtone may be placed in a reverſed form, as  by which there will be a double vacuum, fully ſufficient for the greateſt current; the remainder of the drains, when in arable lands, are filled up with ſtones, to within about eight inches of the ſurface, covered with ſtraw or ſtalks of beans, to prevent the earth from falling between the ſtones, and filled up with the mould out of the drain; the remainder is ſcattered over the land. In draining paſture lands, the turf is carefully laid a-ſide, the drains filled with ſtones to within four or five inches of the ſurface; and the graſs part of the turf is placed thereon, which ſaves the trouble of laying ſtraw, and as effectually prevents the earth from falling between the ſtones into the drains.

The effects of draining are too obvious to require any comment. The general price in Glooceſterſhire is ſix-pence per perch for cutting and completing the drains, three-pence per load for the ſtones raiſed out of the ditches; every perch of draining takes about half a load. The expence of halling muſt be governed by the diſtance they are halled from; but, on an average, may be rated at about four-pence half-penny per load, of a ton and a half to two tons weight; all which expences, amount in the whole, to about one ſhilling per perch. When a ſufficient quantity of ſtones cannot be procured from ditches, the general price of digging is ſix-pence per load. Hence, the total expence is fifteen-pence per perch. And after the land is drained, the manure laid on will prove effectual.

OF

CLEARING LAND

FROM

TREES, &c.

THE next improvement is the clearing of lands from the ſtumps and roots of trees, thorns, briers, &c.

When lands are encumbered with many timber and pollard trees, they are very injurious to paſture and arable grounds; they obſtruct the free circulation of the air and the effects of the ſun. The leaves, particularly of aſh, render the graſs whereon they fall coarſe and ſour; which, when eaten by cows, affect their milk with a ſtrong diſagreeable taſte. Trees attract, their ſhade and root retain, moiſture and acidity in the ſoil; their wide-extended fibrous roots, particularly of aſh and elm, ſtrike horizontally, near the ſurface, to a very conſiderable diſtance; they greatly impoveriſh paſture-grounds, and impede the plow in arable land. The roots of trees grow in proportion to their trunks and branches; therefore, no more than two or three ſhould be left in a field, for cattle to rub againſt, and for ſhade.

When trees are planted, or permitted to remain for timber or for firing, the northern and eaſtern ſides of fields and irregular corners, are the moſt proper ſituations; where they afford ſhelter, and ſerve as a ſcreen againſt cold winds; and do not obſtruct the influences of the ſun and air.

The price of grubing-up trees with their roots is from nine-pence to eighteen-pence, in proportion to their ſize. The tops and buts of aſh and oak are more advantageous for burning into charcoal than if ſold for firing. The expence and general produce I have inſerted as under.

The meaſure of a cord of wood in Gloceſterſhire is eight feet four inches long, four feet four inches high, and two feet two inches broad. The price of cleaving is from twenty-two-pence to two ſhillings and three-pence per cord, varying in proportion to the roughneſs of the wood.

Expences attending the Burning of one Hundred Cords of Wood: Viz.

	£	s.	d.
To the collier for building his cabin, - - - - - - - -	0	5	0
Burning of 263 ſacks, at 6d. -	6	11	6
Halling 263 ſacks to market, do.	6	11	6
Unloading, - - - - - - - - - -	0	12	0
Wear and tear of ſacks, - - -	3	10	0
One hundred cords of wood, generally ſold for firing, at per cord 6s. is - - - - - -	30	0	0
Total Expences	47	10	0

PRODUCE

PRODUCE.

	£	s.	d.
263 ſacks of nine buſhels each, at 6½d. per buſhel, is 4s. 10½d. per ſack, - - - - - - - - - -	64	2	1½
Deduct expences, as before,	47	10	0
Balance, in favour of burning for charcoal	16	12	1½

Excluſive of twenty cart-loads of charcoal aſhes, which I have experienced to be hurtful to vegetation, when applied alone; therefore, the largeſt or coarſeſt parts of the aſhes ſhould be burnt in an open fire, with weeds, briers, &c. by which the inflammable part of the coal will be deſtroyed, and an alkaline ſalt will be procured. The fineſt parts of the charcoal aſhes or duſt ſhould be mixed with the compoſt dunghill.

When lands are cleared from ſuperfluous trees, &c. attention ſhould be paid to the ſurface and condition of the ground.—— Where ants inhabit, their hills ſhould be pared off, (as before directed in p. 55,) carried to the middle of the field intended to be left for paſture, and there mixed with an equal quantity of ſoaper's aſhes, or with one half the quantity of quick lime; when thoroughly incorporated, it muſt be ſpread on the ground (which ſhould be previouſly harrowed,) in the proportion of about one hundred and ſixty buſhels to an acre.

By placing the manure in the middle of the field, it is the ſooner, and at a leſs expence, carried over. But ſhould there be any uneven head lands or banks, ſuch ſhould be plowed and harrowed, the pared hills ſhould be depoſited thereon and levelled, the aſhes or lime ſhould be laid on the middle of the bank, and as ſoon as the lime is ſlaked, it ſhould immediately be mixed with the ant hills and head land; and when well incorporated, ſhould be applied in proportion to the aſhes or lime that has been added.

I have repeatedly uſed lime, mixed with earth and with clay, on paſtures; it freſhened the ſoil for one year, but no viſible amendment or increaſe of crops appeared after. But I have experienced, an addition of rotten dung, mixed with lime and earth, (which had lain a few weeks after being thoroughly incorporated, and then well mixed with the dung,) to be very effectual, more particularly when laid on paſtures that had been previouſly harrowed; the utility of which is illuſtrated in p. 67.

Old paſture lands, or ſuch as retain moiſture by being too flat, are frequently much improved by plowing, and making proper ridges to throw off the water. Then an application of earth and lime, by being intimately blended with the ſoil, is rendered a good manure; and thus applied, it acts very differently to what it does when laid on paſture lands, where it is entirely expoſed on the ſurface, and of courſe is rendered almoſt uſeleſs.

I muſt beg leave to diſſent from the common mode of mixing aſhes or lime with earth, as a compoſt, particularly for ſtiff ſoils. When I apply lime, coal, or ſoaper's aſhes to plowed land, I deem it unneceſſary trouble and expence, to haul, ten loads of lime to a head land or bank containing thirty loads, or in proportion, of earth, which muſt be turned, at leaſt twice, to be properly incorporated; afterwards to load, carry out, and ſpread forty cart loads in lieu of ten. When a head land or bank requires levelling, it ſhould be once plowed to looſen it, which will render it the eaſier for loading; then it may be carried over the land, where it will be mixed and equally pulveriſed with the ſoil by future plowings.

Coal and ſoaper's aſhes may frequently be carried to, and immediately ſpread out of the waggon over the land. Lime may alſo be laid in piles, and as ſoon as ſlaked ſhould be plowed in. Such ſaving muſt appear ſufficiently obvious to any perſon that will take time to reflect. I am fully convinced that every ſoil muſt contain as ſufficient a body for thoſe manures to act upon, as the earth on the head lands; and that ſuch mode of application is equal, if not more effectual. Therefore, when the ground is properly prepared for the reception of the above manures, they ſhould be immediately applied without mixture.—Certainly the depth of the ſoil cannot be materially increaſed by the addition of ten, or even twenty loads of earth per acre. It is the ſtrength and property of the manure only, that can correct bad qualities, and enrich the land.

As a ſimilar compariſon, I will enquire, if a gallon of ſpirits mixed with a gallon of water for ſix months or more, then afterwards mixed with nine gallons of water, can be ſtronger, or of a different quality to one gallon of ſpirits applied immediately to the ten gallons of water? In anſwer, when a gallon of ſpirits has been mixed for ſome time with a gallon of water, and afterwards mixed with nine gallons more of water, part of the ſpirit muſt have evaporated during that period, and at the different times of mixing; conſequently the water cannot be ſo ſtrongly impregnated, as when the ſpirit is immediately mixed with the ten gallons of water.—Such are my ideas (founded on experience,) of the properties of lime when mixed with earth, as a compoſt.

Of PLOWING and HARROWING.

PLOWING is the action of breaking up, opening, and pulveriſing the ſoil, that the roots and tender fibres of plants may be enabled to extend themſelves in queſt of food.

When the ſoil has been well looſened by deep repeated plowings and harrowings, its particles are minutely divided, and the roots of plants have liberty to ſpread freely. Hence are enabled to acquire ſuch nouriſhment, as could not poſſibly be obtained when confined between large impenetrable clods of earth. Thorough plowing in a great meaſure ſupplies the want of manure, by keeping the earth in a looſe ſtate, ready for the reception of the atmoſpherical influences.

Duhamel ſays, "It is much more "profitable to increaſe the fruitfulneſs of "land by tillage than by dung:—1. Be"cauſe only a certain quantity of dung can "oftentimes be had, the produce of twen"ty acres being ſcarcely ſufficient to dung "one; whereas the particles of the earth "may be divided and ſub-divided, *ad in"finitum*. The benefit that can be pro"cured from dung, is therefore limited; "whereas no bounds can be ſet to the ad"vantages which ariſe from tillage.

"2. Moſt plants that are reared in dung, "have not the fine flavour of thoſe that "grow in a good ſoil, which has not been "dunged. Greens and fruits are ſeldom "ſo good in the neighbourhood of great "cities, where dung abounds, as in coun"try gardens, where it cannot be ſo la-

" viſhly beſtowed. But nothing is more
" ſtriking than the difference between
" wine produced by a vine that has not
" been dunged at all, and that which is
" made from a vine that has been greatly
" dunged.

" 3. Dung, which according to Mr.
" Tull, acts by fermentation, cauſes in-
" deed an internal diviſion of the particles,
" which may be of great uſe: but the plow
" not only divides the particles, but changes
" the ſituation, by turning the earth up-
" ſide down. The part which was ex-
" poſed to the influence of the air and
" dews, takes the place of another part
" which is removed from underneath to
" the ſurface, and the earth that is turned
" up is penetrated by the rain and dew,
" and by the rays of the ſun; all which
" greatly conduce to render it fertile.

" 4. Dung harbours inſects, which afterwards feed upon the plants and ſpoil " them. It is well known, that when " lands are dunged in which trees are " planted, their roots are in great danger " of being hurt by inſects: and this is " one of the chief reaſons why Floriſts " baniſh dung from their gardens.

" 5. It is true that dung is equally beneficial to light and ſtiff grounds; but " the ſame may be ſaid of tillage.

" Too ſtrong land is that of which the " parts are ſo cloſe, that roots cannot penetrate them without great difficulty. " Now, if roots cannot extend themſelves " freely in the earth, they cannot draw " from it the food of plants, which, for " want of that food, will droop and languiſh. But when thoſe lands ſhall have " been divided by tillage, when their particles ſhall have been ſo ſeparated, that

" roots are at liberty to extend themſelves, " and traverſe all thoſe ſmall ſpaces, they " will be able to ſupply the plants with " their neceſſary food, and they will thrive " apace.

" Tillage is equally beneficial to light " lands; but for a contrary reaſon. The " fault of theſe lands is their having too " great ſpaces between their particles; " and as moſt of thoſe ſpaces have no communication one with another, the roots " traverſing the great cavities without " touching the particles of the earth, draw " conſequently no nouriſhment from it. " But when the particles have been broken " by repeated plowings, the leſſer intervals are multiplied at the expence of the " greater: the roots have liberty to extend " themſelves, and they glide in, as it " were, between the particles, meeting " with a certain reſiſtance which is neceſ-

" ſary

“ ſary to their taking in the nutritive juice
“ which the earth contains.

“ Mr. EVELYN, quoting SIR HUGH
“ PLATT, ſays, That if you take a cer-
“ tain quantity of even the moſt barren
“ earth you can find, reduce it to a fine
“ powder, and expoſe it for a year to the
“ viciſſitudes and changes of the ſeaſons,
“ and influences of the heavens, it will
“ acquire ſuch a generous and maſculine
“ pregnancy, within that period, as to be
“ able to receive an exotic plant from the
“ fartheſt Indies, and to cauſe all vege-
“ tables to proſper in the moſt exalted de-
“ gree, and to bear their fruit as kindly
“ with us, as they do in their natural cli-
“ mates.” We are to ſuppoſe theſe exotics to have their due degrees of heat and moiſture given them. To what ſhall we aſcribe this great fertility? To the great diviſion of the particles of the earth and the multiplication of their ſurfaces. “ By
“ this

" this toil," (*Viz.* pulveriſing the earth,) adds he, " 'tis found, that ſoil may be ſo " ſtrangely altered from its former nature, " as to render the harſh, and moſt uncivil " clay, obſequious to the huſbandman, " and to bring forth roots and plants, " which otherwiſe require the lighteſt and " holloweſt moulds. But what proves " how beneficial plowing is in ſtrong lands " to facilitate the paſſages of the water, of " the rays of the ſun, and of the roots of " plants, is, that their fertility is ſome- " times increaſed by mixing them with " ſand inſtead of dung. Sand itſelf affords " no nouriſhment: but by preventing the " particles from returning, it produces " the deſired good effects.

" It does not appear, that light grounds " require quite ſo many plowings. It " might even be feared, leaſt by frequent " turnings of ſuch lands, and expoſing " their parts to the ſun, they might be

" exhauſted. But tho' the ſun robs the " earth of its moiſture, yet few of the " particles fit for the nouriſhment of " plants are exhauſted with it; and expe- " rience ſhews, that light lands are bet- " tered by being plowed; either becauſe " the breaking and ſtirring of their parti- " cles renders them fitter to receive the " moiſture of rain and dew, to profit by " the influences of the air, and be pene- " trated by the rays of the ſun; or that the " internal pores are better fitted for the " extenſion of roots; or again, becauſe " frequent plowings deſtroy weeds, which " are more apt to grow in light grounds " than in ſtrong, eſpecially when they are " dunged.

" To prove by an experiment what we " have juſt advanced with reſpect to light " ſoils: let one half of a field to be indif- " ferently plowed, and the other half to " be plowed extremely well.

"Some time after, and in dry weather, "let the whole field be croſs-plowed. "The land of that half the field which "was thoroughly plowed, will be of a "darker colour than that of the other half, "which was but ſlightly plowed. This "ſhews the benefit the land has received "by plowing.

"Some think to ſupply the want of "plowing by harrowing their land greatly after it has been ſown; but this way "of ſcratching the earth is of little ſervice; and, when it is moiſt the horſes "poach and damage it conſiderably."

Duhamel's Huſbandry, p. 15.

In the year 1759 M. Delu gave five plowings to a wheat-field, which had not been dunged; and, at harveſt, had taller and finer corn there than any the neighbouring grounds produced, which had been dunged and cultivated in the uſual way.

I knew a farmer, who had not a ſufficient quantity of dung to cover more than half his fallow, which he ſowed with wheat; the other half he intended for barley, but was adviſed (rather than leave the ground uncropped) to give it two extraordinary plowings, and ſow that alſo with wheat, which he did; and reaped a greater crop of better grain off the undunged than the dunged land.

In ſhort, the advantage reſulting from thoroughly pulverizing the land is ſo great, particularly when plants are growing, that in ſome places it has been found fully to repay the expences, even, of hoing between corn ſown broad caſt.

In February, 1777, I purchaſed the leaſe of my farm of the perſon who occupied it; as I could not get poſſeſſion till May, and wiſhed to have a ſmall field of three acres and a half (which I will call No. I.)

plowed up as ſoon as poſſible, my *judicious, honeſt, and worthy* tenant undertook the management of it to the beſt advantage. The ſoil was a loam, from ſix to eight inches deep, on a ſtone-braſh clay. Accordingly he plowed it the latter end of April, and immediately ſowed it with poplar peas.

Expence and Produce as under: Viz.

	EXPENCE.	£	s.	d.
1777.	Rent, taxes, &c. - -	4	11	0
Ap. 29.	Once plowing, and draging 3½ acres	2	0	0
	6½ buſh. ſeed, at 4s. 6d.	1	9	3
	Weeding, - - - - - - -	0	6	0
Sep. 13.	Cutting, - - - - - - -	0	7	0
	Harveſting, - - - - - -	0	9	0
	Hauling, ſtacking and thatching, - - - -	0	15	0
	Threſhing, 13 days, -	0	15	2
☞ No expence to market, the produce ſold at home.		10	12	5
Amount of produce, - - - -		5	12	0
Loſs on 3½ acres, - - - - - - -		5	0	5
Or 1l. 8s. 8d. per acre.				

	PRODUCE.	£	s.	d.
1777.				
Nov. 13.	17½ buſhels, at 5s. -	4	7	6
	1½ buſh. tailing, at 3s.	0	4	6
	Straw, - - - - - - - -	1	0	0
		5	12	0
Loſs, - - - - - - - - - - - - -		5	0	5
		10	12	5
Produce near 5½ buſhels per acre.				

Moſt execrable huſbandry.

OBSERVATIONS.

The above field contained many cammocks, ſome ant-hills, and had been very irregularly laid down, which induced me to plow it.

The *judicious tenant* remarked, that it had always been his and his neighbours' cuſtom, to ſow their lands with peas as ſoon as broken up, for they thought it a great loſs to fallow land; and if their grounds were not cropped they could not pay their rents. Had he, or his neighbours, kept an account of the expence and produce of ſuch fallacious œconomical proceedings, he would ſoon have been convinced, that thoſe ſavings in huſbandry produce poverty; that proper fallowing would have been more beneficial to the land, and attended with much leſs trouble and loſs than if ſuch a deteſtable method of culture had not been practiſed; which clearly points out the diſadvantages attending the want of good and proper tillage.

Of FALLOW CROPS and FALLOWS.

EXPERIENCE enables me to ſay, that ſummer fallows are unneceſſary on lands that can be brought into proper tillage for fallow crops. The moſt attentive obſervations and experiments have inſtructed me, that when paſtures are intended to be broken up, the beginning of October is the moſt advantageous ſeaſon. At that time vegetation begins to decline, conſequently the produce of the land is but of little value till the ſucceeding ſpring.

If the ground is broken up early in October, and immediately rolled with a heavy ſtone roller, the ſward will be ſo cloſed, as ſpeedily to ferment and rot. When the ſurface begins to crumble, it ſhould be harrowed, that the earth may be looſened and prepared to receive the benefits of the air, rain, and froſt.

About the middle of December it ſhould be obliquely plowed, as deep as the ſtaple will admit. By this mode, the baulks that were made at the firſt plowing will be corrected.

The land being thus left in its rough ſtate, will be expoſed to the winter froſts, which will penetrate the hard clods; and, by its expanſive force, greatly aſſiſt in pulveriſing the ſoil.

In the month of February, as ſoon as the weather permits, it muſt be well worked with heavy harrows, by which the clods will be greatly, if not totally reduced; and by being thus divided, will receive farther benefit from the influences of the atmoſphere.

In the month of March the land ſhould be again rolled, to break the remaining clods; which being preſſed into the ground, muſt be looſened and pulveriſed by harrowing. In this ſtate the earth ſhould remain for ſix or ſeven days, to receive farther benefit from the atmoſphere, which will render the ſoil more friable than if it had been immediately ſowed and harrowed.

The latter end of March, or beginning of April, has been the time when my land has been ſown broad-caſt with poplar peas, harrowed in.

The Expence and Produce per Acre, as under:

	£	s.	d.
Rent, tythe, and taxes, - - -	1	6	0
Breaking-up, - - - - - - - -	0	7	6
Two plowings more, at 6s. 6d.	0	13	0
Two Rollings, - - - - - - - -	0	2	0
Four Harrowings, - - - - - -	0	3	0
2½ buſhels of ſeed, at 4s. 6d. -	0	11	3
Frightening birds, - - - - - -	0	3	0
Weeding performed by women	0	1	0
Cutting, - - - - - - - - - - -	0	1	6
Harveſting, - - - - - - - - -	0	2	0
Hauling, ſtacking and thatching,	0	3	0
Threſhing 25 buſhels, at 2½d. -	0	5	2½
Carrying to market, - - - -	0	4	0
£	4	2	5½

PRODUCE.

	£	s.	d.
Twenty-five buſhels, at 4s.6d.	5	12	6
Straw, - - - - - - - - - - - -	0	10	0
	6	2	6
Deduct, expences, - - -	4	2	5½
Clear profit, per acre, - -	2	0	0½

By this method of cultivation, in lieu of a loſs of 1 l. 8 s. 8 d. there ariſes a clear profit of 2 l. 0½ d. per acre, which fully proves the great advantage of good tillage, even by the old mode of huſbandry.

But the advantage of the new and drill, to the very beſt old method of cultivation, are great. By the old the ſeed is irregularly ſcattered, and buried at unequal diſtances and depths. By the drill the ſeed is depoſited at ſuch a certain required regular diſtance and depth in the ground, as to meet with moiſture. Every ſeed will ſoon vegetate, and even in the drieſt ſeaſon will produce one extraordinary crop, from five to twenty buſhels per acre, more than by the common mode. The ſeed, by drilling, is alſo ſecured from birds. The intervals admit being hoed and cleaned from weeds, while the ground is preparing for a ſucceeding crop.

I have before-mentioned, that the beginning of October is the beſt ſeaſon for breaking-up old paſture-lands, and as it may be deemed neceſſary I ſhould add theory to experiment, to illuſtrate and confirm ſuch an aſſertion, I muſt obſerve, that heat with moiſture, are eſſentially neceſſary to promote fermentation; which will, in the two months of October and November, rot the ſward or turf more than in the four ſucceeding months, and reduce the ſoil to a proper ſtate for the ſecond plowing in December; which, with the other operations, will ſufficiently pulveriſe it for the reception of a fallowing crop in the month of March or April.

As the days ſhorten the cold increaſes. Cold ſtops or prevents fermentation. — Hence, when lands are plowed late in November, the ſward will not be ſufficiently rotted to receive a fallow crop in the ſucceeding ſpring. Thus circumſtanced, I have found it more advantageous to winter and ſummer fallow land for a crop of wheat, than to plant or ſow a fallow crop, when the ſoil has not been ſufficiently pulveriſed.

In the year 1781, I cleared a field, (which we will diſtinguiſh by No. III.) of many ſuperfluous pollard trees. The ſoil about ſix inches deep, on a ſtiff clay, and the very worſt ground belonging to my farm. In November, 1782, I broke it up with four horſes. As the land contained many roots of trees it was with great difficulty that three-quarters of an acre could be plowed in a day. The ground was afterwards rolled with a heavy ſtone roller to cloſe the ſward, that it might rot the ſooner. When the ſurface began to crumble, I had it well harrowed, that the clods might be the more minutely divided, and expoſed to the influences of the atmoſphere. In March, 1783, I gave it an oblique plowing, as deep as the ſtaple would admit. By this mode, the balks, that had been made at the firſt plowing were corrected.

As I am not fond of fallows, but greatly approve of fallow crops, when the land is properly pulveriſed; it was my intention to have planted this field with potatoes, peas, or beans. But when plowed the ſecond time, the ſward was not ſufficiently rotted. In this rough ſtate therefore it remained near a month; during which time the atmoſphere had ſufficiently mellowed it; afterwards I had it well worked with loaded harrows. In the month of June, the remaining clods were broken by a ſtone roller, and the ground manured with about two hundred and twenty buſhels of ſoaper's aſhes per acre, ſpread on the land out of the waggon. The manure was well incorporated with the ſoil by harrowing;

ing; and by immediate plowing, the aſhes fermented and diſſolved the half-rotted graſs and roots. In the month of September the land was again well harrowed. On the 7th of October finiſhed plowing and ſowing with cone wheat. At the laſt plowing the manured ſtratum was turned on the ſurface; hence, the corn was nouriſhed by the fertilizing properties of the aſhes, which were waſhed down by rains, and thereby became intimately blended with the earth. Whereas, had the manure remained buried, the upper ſtratum of the ſoil could have received but little benefit.

Expence and Produce as under:

1782.		£	*s.*	*d.*
Nov. 16.	Breaking-up, per acre,	0	8	0
	Three plowings more at 6 s. 6 d. - - -	0	19	6
	Two rollings, - -	0	1	6
	Carried over	1	9	0

		£	s.	d.
	Brought over, -	1	9	0
1783.	Four harrowings, -	0	4	0
July	Four waggon loads of ſoaper's aſhes, and carriage, at 10 s. - - -	2	0	0
Oct. 7.	Two buſhels of ſeed, at 7 s. - - - - - -	0	14	0
	Clearing water furrows	0	2	0
	Frightening birds, -	0	1	0
	Weeding, - - - - -	0	2	0
	Reaping and pooking	0	8	0
	Carrying-in, ſtacking and thatching, -	0	2	0
	Threſhing and winnowing 26 buſh. 3 pecks, at 7 s. - -	0	15	7
	Carrying to market, at 1½d. per buſhel,	0	3	4
	Two years rent, tythe and taxes, - - -	2	0	0
		8	0	11

PRODUCE.

1784.	£	s.	d.
Oct. Sold 20 buſh. for ſeed, 9 gallon meaſure, at 7s. 9d.*	7	15	0
6¾ buſhel to bakers, at 7s.	2	7	3
20 dozen of ſtraw, at 1s.	1	0	0
	11	2	3
Expences deducted, - -	8	0	11
Clear profit, per acre, on two years, - - - - - - - - -	3	1	4
Or,			
Clear profit, per acre, on one year, - - - - - -	1	10	8

In the month of November, 1783, I broke up a field, which I will mark Number IV. The ſoil of the ſame quality as

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* The price of wheat is conſiderably reduced ſince the year 1784; therefore, what is at preſent deficient in price, may, with a certainty, be made more than equivalent in the increaſe of produce, by proper culture, drilling, and hoeing.

No. I. It was immediately rolled after plowing. In December it was well harrowed. In March it was manured with twenty cart-loads of dung and ſoaper's aſhes mixed, and immediatly plowed in. In April it was harrowed as well as the ſward (which was not rotted) would admit of. In May it was plowed, harrowed, and planted with potatoes in plowed furrows, ſix inches deep, and in rows about twenty inches diſtant from each other.

Expence and Produce as under : Viz.

1783.		£	*s.*	*d.*
Nov. 26.	Breaking up, - -	0	7	6
	Two more plowings, at 6s. 6d. - - -	0	13	0
	Two rollings, - -	0	1	6
	Three harrowings, -	0	3	0
	Twenty cart-loads of compoſt, at 3s. * -	3	0	0
	Carried over -	4	5	0

Brought

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* The compoſt was the ſcrapings of a lime-ſtone road, ſoaper's aſhes, and dung.

	£	s.	d.
Brought over, -	4	5	0
Spreading, - - -	0	1	8
19 buſh. potatoes, at 10d.	0	15	10
Cutting ditto, - -	0	2	3
Plowing and planting,	0	12	0
Twice horſe-hoeing,	0	9	0
Digging 69 ſacks, at 4d.	1	3	0
Wear and tear of baſkets	0	1	0
1 year's rent, taxes, &c.	1	6	0
Carrying to market 69 ſacks, at 3 d. -	0	17	3
	9	13	0

PRODUCE.

	£	s.	d.
Sixty-nine ſacks, at 3 s. - -	10	7	0
Deduct expences, as above, -	9	13	0
Clear profit, per acre, - -	0	14	0

In order to illuſtrate the ſuperior advantages accruing from good management and thorough tillage, to improper management, by the erroneous ſavings of labour and expence; I muſt now revert to the ſecond produce of my fallow crops, from whence we ſhall be enabled to draw ſome concluſion, of the method moſt beneficial for cultivating a loamy and ſtiff ſoil. Therefore we will begin with

The FIELD,

(No. I.)

Which, as ſoon as the peas were carried off, was cultivated as follows, and ſowed with cone or hard wheat.

The Expence and Produce per Acre, as under:
Viz.

	£.	s.	d.
Two plowings, - - - - -	0	13	0
Two harrowings, - - - - -	0	2	0
One rolling, - - - - - -	0	1	0
2 buſhels ſeed wheat, at 7s. 6d.	0	15	0
Clearing water furrows, - -	0	2	0
Frightening birds, - - -	0	1	0
Weeding, - - - - - - -	0	2	0
Reaping and pooking, - -	0	6	0
Carrying in, ſtacking and thatching, - - -	0	1	6
Threſhing and winnowing 12½ buſhels, at 7d.	0	7	3½
Carrying to market, at per buſhel 1½d. - - -	0	1	6½
Rent, tythe, and taxes, - -	1	6	0
£.	3	18	4

PRODUCE.

	£.	s.	d.
12½ buſhels wheat, at 5s. 6d.	3	8	9
Thirteen dozen ſtraw, - -	0	13	0
	£. 4	1	9
Deduct expences, - -	3	18	4
Clear profit per acre, -	0	3	5

One buſhel, nine gallon meaſure, weighed ſixty-ſix pounds ten ounces.

OBSERVATIONS.

The ſward was not half rotted; had the ſoil been manured with lime or ſoaper's aſhes, the graſs and roots would have been diſſolved, and the land would have been better pulveriſed. The ſucceeding year, this field was manured with coal and ſoaper's aſhes, then planted with potatoes, after with wheat, which produced upwards of thirty-four buſhels per acre, each buſhel (of nine gallon meaſure,) weighing ſeventy-two pounds.

The FIELD,

(No. 2.)

Was plowed three times, and alſo ſowed with wheat.

Expence and produce as under:

	£.	s.	d.
Three plowings, at 6s. - -	0	18	0
One rolling, - - - - - -	0	0	9
Two harrowings, - - - -	0	2	0
2 buſhels ſeed wheat, at 6s. 6d.	0	13	0
Clearing water furrows, -	0	2	0
Frightening birds, - - - -	0	1	0
Weeding, - - - - - - -	0	2	0
Reaping and pooking, - -	0	8	0
Carrying in, ſtacking and thatching, - - -	0	2	0
Threſhing and winnowing 25½ buſhels, at 7d.	0	14	10½
Rent, tythe, and taxes, - -	1	6	0
£.	4	9	7½

PRODUCE.

PRODUCE.

	£.	s.	d.
25½ buſhels wheat, at 6s. 6d.	8	5	9
Straw, - - - - - - - - -	1	0	0
	9	5	9
Deduct expences,	4	9	7
Clear profit per acre,	4	16	2

OBSERVATIONS.

When the peas were cut, the land appeared mellow, moiſt, and of a blacker colour than when ſowed. The ſward was perfectly rotted, and but few weeds ſprung up to interrupt the growth of the wheat. A buſhel of which (nine gallon meaſure,) weighed ſixty nine pounds and thirteen ounces.

The FIELD.

(No. 4.)

After the potatoes were dug out in November, the field was once plowed in high narrow ridges, in which ſtate it remained till March, when it was harrowed, and was ſo well pulveriſed by the froſt, as to require but one plowing in April; when it was again planted with potatoes, in rows about twenty inches apart. The ſets from ſix to nine inches diſtance in the rows.

Expence and produce as under, viz.

	£.	s.	d.
Two plowings, - - - - -	0	12	0
Two harrowings, - - - - -	0	2	0
20 buſhels potatoes, at 1s. - -	1	0	0
Cutting the ſets, - - - - -	0	2	3
Plowing and planting, - - -	0	12	0
Three horſe hoeings and weeding,	0	13	0
Digging 104 ſacks, at 4d. - -	1	14	8
Baſkets, - - - - - - - - -	0	1	0
Cartage and unloading, - -	0	4	4
Rent, tythe, and taxes, - -	1	6	0
	£. 6	7	3

PRODUCE.

	£.	s.	d.
104 ſacks, neated by fattening hogs. } at 3s. 6d.	18	4	0
Deduct expences, - - -	6	7	3
Clear profit per acre, - -	11	16	9

This field was brought into excellent tilth, and altho' the ſeaſon was late, I ſowed it with cone wheat, (as will be hereafter mentioned,) and reaped a good crop of excellent grain, weighing ſeventy - two pounds ſeven ounces and a half per buſhel, of nine gallons.

We will now take a retroſpective view of the profit and loſs on the different fields, No. 1, 2, and 4, the ſoil of which was as near of the ſame quality as poſſible. By comparing the different expence and produce, we may be the better enabled to conclude on the moſt advantageous method of cultivation.

FIELD,

(No. 1.)

First crop peas.——See page 122.

EXPENCE.

	£.	s.	d.
10l. 12s. 5d. on 3½ acres, is per acre - - -	3	0	8

PRODUCE.

	£.	s.	d.
5½ buſhels ſold for - - -	1	12	0
Loſs on firſt crop per acre	1	8	8

Second crop wheat.——See page 138.

PRODUCE.

	£.	s.	d.
12½ buſhels ſold for - - -	4	1	9
Expences, - - - - -	3	18	4
Clear profit, - - - - -	0	3	5

Which deduct out of 1l. 8s. 8d. loſs on the firſt crop, there then remains a loſs of 1l. 5s. 3d. on the two years crop.

This wheat weighed ſixty-ſix pounds ten ounces per buſhel, of nine gallons.

FIELD,

(No. 2.)

First crop peas.——See page 127.

PRODUCE.

	£.	s.	d.
25 buſhels ſold for - - -	6	2	6
Expences, - - - - - -	4	2	5
Clear profit on firſt crop,	2	0	1

Second crop wheat.——See page 140.

PRODUCE.

	£.	s.	d.
25½ buſhels, - - - - - -	9	5	9
Expences, - - - - - -	4	9	7
Clear profit on ſecond crop,	4	16	2
Add clear profit on firſt crop,	2	0	1
Two years clear profit per acre,	6	16	3

Or, 3l. 13s. 1½d. per acre per annum.

The wheat weighed ſixty-nine pounds and thirteen ounces per buſhel, of nine gallon meaſure.

FIELD.

(No. 4.)

Firſt crop, potatoes.——See page 136.

PRODUCE.

	£.	s.	d.
69 ſacks, ſold for - - -	10	7	0
Expences, - - - -	9	13	0
Clear profit on firſt crop,	0	14	0

Second crop, potatoes.——See page 143.

PRODUCE.

	£.	s.	d.
104 ſacks, - - - - - -	18	4	0
Expences, - - - - - -	6	7	3
Clear profit on ſecond crop,	11	16	9
Add firſt year's clear profit,	0	14	0
Two years clear profit per acre,	12	10	9

Or, a clear profit of 6l. 5s. 4½d. per acre per annum.

Excluſive of a larger crop of wheat and better grain being afterwards produced; a buſhel of which wheat weighed ſeventy-two pounds ſeven ounces and a half.

FIELD,

(No. 3.)

First year fallow.—Second wheat.

See page 134.

PRODUCE.

	£.	s.	d.
26¾ buſhels, - - - - - -	11	2	3
Expences, - - - -	8	0	11
Clear profit in two years,	3	1	4

Or, 1l. 10s. 8d. per acre per annum.

The wheat weighed ſeventy-one pounds per buſhel, nine gallon meaſure.

Thus we ſee that land of equal goodneſs does, by different management, produce very different profits.

By the field No. 1, there is a loſs of 1l. 5s. 3d. in two years, or 12s. 7½d. per acre per annum, with the land being left in bad condition.

By the field No. 2, there is a clear profit of 6l. 16s. 3d. in two years, or 3l. 8s. 1½d. per acre per annum, with the land being left in good condition.

By the field No. 4, there is a clear profit (even after an expence of 3l. 1s. 8d. for manuring,) of 12l. 10s. 9d. in two years, or 6l. 5s. 4½d. per acre per annum, with the land being left in excellent condition; which afterwards produced a crop of wheat, ſuperior in every reſpect to any of the other fields.

I think that theſe experiments and obſervations evidently confirm, that ſavings of manure and labour in huſbandry produce poverty; that lands are too frequently brought into diſrepute from the want of proper management; and that it would be much more advantageous for the landlord, and particularly the tenant, that he ſhould cultivate one hundred acres in a compleat manner, inſtead of his occupying two hundred acres, which his circumſtances will admit of only half plowing, and cultivating in a ſlovenly and very imperfect manner.

It appears to me, that Providence never intended tilled land ſhould remain uncropped. Becauſe weeds will naturally grow on the pooreſt, as well as better ſoils; and occupy land, which, with judicious management,

nagement, may be advantageouſly cultivated by meliorating hoed crops; and thoſe vacancies in corn fields, where grain has been ſown too thin, or deſtroyed by birds, are generally filled with weeds, which impoveriſh the ſoil more than corn. Hence, fallows are unprofitable and unneceſſary.

I have made ſeveral experiments on fallow crops, which if inſerted, would ſwell this Treatiſe far beyond its limits; and as they might tend more to perplex than to convey uſeful knowledge, will only obſerve, that I have experienced clayey and ſtiff loams to be improper ſoils for parſnips, carrots, and turnips; the laſt generally had a kind of pungent taſte, and grew ſtringy; and ſheep, which had not been accuſtomed to turnips, would not eat them.

Curious reſearches into the works of Providence, will inveſtigate the cauſe why ſome crops improve lands more than others; let this enquiry be our preſent attempt.

Beans are a good fallow crop. Their tap roots will grow from twelve to eighteen inches or more, perpendicularly deep in a loamy ground. Their numerous fibres or lateral roots will extend themſelves horizontally in a well looſened ſoil, as long as their roots, and their ſize will be in proportion. Conſequently the increaſe of produce will alſo be, in proportion to the growth of the roots and fibres. But when the ſtratum of loam is not more than about ſix or eight inches deep on a clay, their roots cannot penetrate into, nor procure ſuch ſtore of nouriſhment, as when planted in a deep loam; and of courſe the crops cannot be ſo fruitful. I have particularly obſerv'd in dry ſummers, that the greater the diſtance between, and the thinner the beans grew in the rows, the more they were blighted; but when thick they were not much affected. To what can we attribute this? After a few minutes reflection, I believe we can impute it to no other, than that the beans are not ſet at a proper depth in the ground, or the rows are at ſuch a diſtance from each other, as not to afford ſufficient ſhade, to prevent the ſun from exhaling more moiſture from the roots than what is returned by dews, or from want of proper hoeing. Therefore the plants are deprived of nouriſhment, and from the want of a proper ſupply of juices become ſickly; or the circulation may be ſtopped in the leaves and extreme parts of their ſtalks, by cold drying winds. Hence the perſpiration is converted into a ſweet mucilage, which harbours the black inſect called the dolphin, but vulgarly termed the blight. In ſhort, I have experienced potatoes, and poplar peas when drilled, to be more certain, profitable, and ſuperior to any other fallow crops, or fallows, for ſuch ſoils.

Beans, peas, potatoes, and every other vegetable that produce a ſucculent leaf, imbibe much nouriſhment from the atmoſphere; their ſhade prevents the ſolar rays exhaling the moiſture from their roots, which are very numerous. In a well pulveriſed ſoil, the roots of peas will extend horizontally from twelve to eighteen inches, for the cloſer the peas are planted in the drills, the more they thrive and enrich the land; and inſtead of robbing each other of their food, they become combined into a formidable body. Therefore, by ſupporting each other, they are better enabled (than when ſingle or few in number,) to force their paſſage thro' the earth in ſearch of food. The more numerous are the plants of peas, the thicker is the ſhade, and the more is the moiſture retained in the ground. Hence they cauſe a putrid fermentation' which fertilizes the ſoil. Early hoeing kills weeds, or prevents their growth, ſo as to be ſoon ſtifled by the drilled peas; it alſo looſens the ſoil, and admits the extention of the roots.

Potatoes are generally ſuppoſed to impoveriſh land. My crops of wheat after potatoes, have in every experiment, proved much greater, heavier, and finer grain, than after any other vegetable or fallow equally manured. And in the field, No. 4, (ſee page 143) I had two ſucceſſive crops of potatoes, the laſt of which produced thirty-five ſacks more than the firſt; with an excellent ſucceeding crop of wheat, and the ground being left in good order, gives me reaſon to conceive, that potatoes do not impoveriſh the land ſo much as is generally imagined.

In order that I might have an opportunity more conveniently and minutely to inveſtigate the growth of potatoes, and to attain ſome further knowledge of the moſt advantageous method of their cultivation, I made the following Experiment, viz.

On the 10th day of May laſt, I had ſix ſcotch potatoes, that weighed two pounds and two ounces, cut into thirty-three ſets, with two eyes each, which were planted in a ſtiff deep ſoil, with a ſmall quantity of rotten dung ſcattered under and over the ſets, which were placed about ſix inches deep, at the following diſtance in the rows, divided by pegs:

No. 1	11 cuts at	6 inches diſtance.
2	11 ditto	9 ditto.
3	11 ditto	12 ditto.

They were hoed twice.

On the 10th of October the earth was carefully drawn from off the plants, which were extended acroſs the rows, each meaſuring alike one foot.

PRODUCE.

PRODUCE.

No.	Potatoes.	Weighed. lb.	oz.	Occupied.
1	124	28	10	6 feet in length.
2	130	32	2	9 ditto.
3	145	31	2	13 ditto.
	Total weight	91	14	

Although the ground was dug about a foot deep, the plants and fibres did not grow perpendicularly, but horizontally acroſs the rows, ſo far and ſo high as the looſened or hoed earth extended. Hence it evidently appears, that the ſoil being continually moved by the growth of the potatoes and hoeing, its particles are ſo minutely divided, as to permit the free admiſſion for the atmoſpherical influences, which fertilize the land, and render the ſucceeding crops more productive than after any other fallow crop; for the ſoil being

ing more pulveriſed, the roots of the ſucceeding plants can the eaſier range in ſearch of food; which, in proportion to the nouriſhment they acquire, fills the grain, and makes it weigh heavier, than when its roots are confined; and is the moſt certain proof, that good tillage is one of the greateſt ſecrets in Agriculture.

The next fallow crop that ranks as ſecond on my liſt, is peas; their effects as a meliorating crop has been already explained. As they are generally cut early, time permits to give the better tillage for wheat. And from the experiments which I have made, do believe, that on good loamy or ſtiff ſoils, wheat, drilled and hoed, may alternately ſucceed either potatoes, peas, beans, buck wheat, or any other meliorating hoed crop, for any number of years; provided the ſtubble is immediately, or ſoon after harveſt, plowed as deep as the ſtratum will admit, into one bout ridges, by which the ſoil will be kept dry and expoſed to the froſts, that will pulveriſe it. This mode, with the addition of proper manure once in about four years, will keep the land in excellent order and improve it. I have experienced, that one plowing in autumn is of more benefit than two plowings in the ſpring.

OF THE

DRILL HUSBANDRY.

DRILLING is the ſowing, planting, or depoſiting, in regular rows, any kind of grain, ſeeds or pulſe, of any required quantity, at any required depth in the earth, and diſtance between the rows.

The ſuperior advantages ariſing from the drill, over the broad-caſt or common mode of huſbandry, are great and numerous. By the common mode of ſowing, the general quantity of wheat uſed, is from two to two and half buſhels per acre;

of

of barley about four buſhels per acre; and other ſeeds in proportion; the ſeed is thereby irregularly ſcattered over the ground, and either dragged or plowed in; when dragged, great quantities of ſeed remain uncovered, part lies ſo near the ſurface of the earth, which is waſhed off by the firſt heavy ſtorm of rain, and the ſeed is expoſed to the ravages of the birds, or lies ſo ſhallow as to be hove out of the ground by ſevere froſts. Hence, near one half of the ſeed ſo ſown is entirely loſt, and the remaining part is depoſited at ſuch unequal depths as to prevent a regular ripening. When plowed in, great part is buried ſo deep as to be rotted by the wetneſs of the ſoil, or produce ſmall thin ears, and frequently but a ſcanty crop. Grain, ſown broad caſt, grows ſo irregular as to exclude the free admiſſion of the air, and cannot be hoed.

When wheat is drilled in rows, at the diſtance of eleven or twelve inches, about three pecks; if at nine inches, about one buſhel; if at ſix or ſeven inches, about a buſhel and half a peck is ſufficient for an acre. About one buſhel and a half of barley at ſix inches, or leſs in proportion, when ſown at nine or twelve inches, is fully ſufficient for a ſtatute acre of rich land, properly cultivated. Thus, more than one-half of the ſeed of wheat, and five-eighths of the ſeed of barley is ſaved, excluſive of the great increaſe of crops.

By drilling, the grain is depoſited at an equal depth, and regular diſtance in the ground; it is at the ſame time covered, and ſecured from the birds; every grain that is good will vegetate, and produce an even crop, far ſuperior in quantity and quality to any ſown broad caſt.

When vegetables are drilled, from ſix inches to any greater diſtance in the rows, they enjoy the free admiſſion of air, and the intervals can be hoed at a leſs expence than weeded; the other advantages of hoeing will be hereafter illuſtrated. When grain is drilled, it is not ſo ſubject to be beat down by rains and high winds. Its ſtalks are ſo much ſtronger than the ſtalks of broad caſt grain, as to be better enabled to ſupport their larger heads againſt tempeſtuous weather; and when their ſtalks bend under their heavy loads, each row ſupports the other in ſuch a manner, as ſoon to riſe again without being injured. Drilled and hoed crops, as being free from weeds, may be reaped lower and with leſs difficulty than broad caſt crops, which are often laid with ſtorms, and ſo entangled, as to be cut at a greater expence and loſs of grain, as alſo loſs of ſtraw, where weeds grow high.

The ſuperior increaſe of drilled and well hoed crops, to broad caſt, are generally from ſix to twenty, or thirty buſhels per acre, in proportion to the natural richneſs and proper culture of the ſoil; and the ſuperior weight of drilled grain is about two pounds per buſhel.

Other advantages accrue from drilling in dry ſeaſons. The ſeed by being depoſited from two to not exceeding three inches in the ground will meet with moiſture, ſoon vegetate, and produce even fruitful crops; while the broad caſt lies ſo near the ſurface, or at unequal depths, as to be parched by the heat of the ſun, or buried too deep to afford but very ſcanty, unequal ripened crops. Drilling alſo enſures a certain crop in all ſeaſons.

Every Agriculturiſt, and all others, have an undoubted right to enjoy their own opinions; but every unprejudiced Agriculturiſt muſt, after a few minutes reflection, beſt judge which is moſt advantageous, to raiſe a crop of fifty buſhels of wheat at five ſhillings, or thirty buſhels at ſix ſhillings per buſhel, excluſive of one buſhel of ſeed ſaved per acre.

Simplicity and ſtrength of machines, conſtructed on the moſt accurate mathematical principles, are the beſt calculated for the uſe of common plowmen. Hence are moſt worthy the farmer's attention, who will not heſitate to pay from twenty to thirty pounds for a waggon that may be worked a few years. He cannot do without it.

A ſtrong machine at an expence of fifteen pounds, will with care laſt thirty years; but before we proceed further, it is neceſſary to enquire how a farmer can be benefited by paying fifteen pounds for ſuch a piece of mechaniſm? And in order to attain proper ideas of ſome return for his fifteen pounds, we will make the following candid calculation of a farm, whereon is cultivated annually, one hundred acres of wheat, and one hundred acres of barley: viz.

From two to two buſhels and a half, nine gallon meaſure, of ſeed wheat, being the quantity generally ſowed broad caſt, one buſhel is ſufficient for drilling per acre. Four buſhels, nine gallon meaſure, of barley, being the quantity generally ſowed broad caſt, one and a half buſhel is ſufficient for drilling per acre. Therefore there is a ſaving, by drilling, of

	£	s.	d.
100 buſhels of wheat, at 5s.	25	0	0
250 buſhels of barley, at 3s.	37	10	0
The leaſt extra crop 6 buſhels per acre.			
600 buſhels of wheat, at 5s.	150	0	0
600 buſhels of barley, at 3s.	90	0	0
£.	302	10	0

Excluſive of an extra increaſe of ſtraw, and the land being kept in better condition by hoeing.

However marvelous the above calculation may appear, I will with certainty aſſert it as a real fact, that the above extra produce from drilling, even on a midling ſoil, properly prepared as for common ſowing, is conſiderably under rated.

Theſe aſſertions are not ideal, but are founded on facts and experiments.

We will further examine which is moſt advantageous to the judicious farmer, a waggon that may gain him thirty pounds (being its full value) in one year, or a ſtrong machine without the leaſt complex work, that will with care laſt him upwards of thirty years, and will gain him more, nay, much more than three hundred pounds in one year.

I will now make my calculation on a ſmaller ſcale. A farmer, who has under tillage fifteen acres of wheat, and fifteen acres of barley, may ſuppoſe that the advantages reſulting from ſuch a machine may not be adequate to the expence:—Without calculations no proper ideas can be formed, therefore we will proceed.

	£.	s.	d.
15 buſhels of ſeed wheat ſaved, at 5s. - - -	3	15	0
37½ buſhels of ſeed barley ſaved, at 3s. - - -	5	12	6
90 buſhels of wheat, being an extra produce, -	22	10	0
90 buſhels of barley, ditto -	13	10	0
£.	45	7	6

Excluſive of ſtraw, &c.

How far a farmer may think it an object to procure a machine that will coſt him fifteen pounds, which will with care laſt him upwards of thirty years, and gain him forty-five pounds the firſt year, muſt be left to his conſideration.—But I muſt beg leave to make one obſervation, that the lenient laws of this happy iſle do not compel men to get or ſave, any more than oblige them to ſpend money, contrary to their own free will and inclinations. This makes me recollect a circumſtance that occurred laſt September, which I cannot paſs over unnoticed: A farmer, whom till then I had always eſteemed as a ſenſible man, held ſome converſation with me on the ſubject of drilling; he had ſeen my crops, which he acknowledged to be far ſuperior to my neighbours; I informed him of all its ſuperior advantages over the common mode of huſbandry; that the kingdom would be immenſely benefited by the ſaving of ſuch aſtoniſhing quantities of ſeed; by the amazing increaſe of crops and ſtraw, which might be converted into manure for enriching the land; by enabling us to ſupply our colonies with flour on reaſonable terms; by reducing the price of bread to the poor; that it would be much more advantageous for the farmer to raiſe a produce of even thirty buſhels, at five ſhillings, which is ſeven pounds ten ſhillings, than to reap a crop of only twenty buſhels per acre, at ſix ſhillings, which is ſix pounds; and that the tenant would thereby be better enabled to pay his rent. That I was fully convinced, when a man ſaw his neighbours fields produce a much more fruitful crop than his own, however prejudiced he might be againſt new modes, he would in a ſhort time purſue the ſame mode; and that the new ſyſtem, with the drill huſbandry, muſt very ſpeedily become general, as being of the greateſt national utility. In ſhort, although he appeared to be convinced, yet the purport of his anſwer was, that if he varied from the old mode, his landlord would ultimately reap the advantages, his rent would be raiſed, and that he was well contented with his ancient ſyſtem. Happy that ſuch an opinion does not always prevail.

The numerous experiments which I have made on a ſmall ſcale, and which I have this ſeaſon extended on a larger one, enable me with certainty to ſay, that grain drilled about ſix or ſeven inches diſtance between the rows, produce the largeſt crops. Particular inveſtigations and obſervations teach me, that in cloſe rows, the roots and fibres get ſo combined, and acquire ſuch ſtrength, as to penetrate better into, keep the ſoil more open, and by a kind of ſympathy enables them to thrive better and ripen earlier, than in wider intervals. The rows of grain at ſix or ſeven inches diſtance, ſmother the weeds, cauſe a putred fermentation in the ground, prevent the moiſture being exhaled by the ſun, and the fibres being ſcorched by the ſummer's heat. At harveſt, the ground is moiſter, and appears much blacker than in wider intervals.

When grain is ſown in rows, with intervals of twelve or nine inches, the weeds grow much more luxuriant, and the ſun in ſummer has more power and greater acceſs to the roots of plants. Hence, ſix or ſeven inches I deem to be the beſt diſtance between the rows of corn. Experiments of this kind may be eaſily made without any extra expence, and the inquiſitive Agriculturiſt will be ſoon convinced of the above diſtance being the moſt advantageous.

When carrots are drilled at the diſtance of twelve inches between the rows, one man can hoe two acres a day, and the plants are thinned at leſs than half the expence of thoſe ſowed broad caſt.

Turnips are generally ſowed in the drieſt ſeaſon of the year; by drilling at one, or one inch and a half deep, the ſeed is depoſited in moiſture. and will produce a more certain crop; they ſhould be drilled at a diſtance of fifteen inches between the rows, when the intervals ſhould be hoed with a running or breaſt hoe of twelve inches broad; they alſo are more expeditiouſly thinned in the rows, and at one half of the expence of thoſe ſowed broad caſt.

Thus, by ſaving expence and time by hoeing, the labourer may be employed in clearing the ſides of banks from weeds, thorns, &c. or any other neceſſary work.

Dr. HUNTER's OBSERVATIONS ON DRILL SOWING.

" THE anatomical inveſtigation of
" the roots of wheat and other
" grain, has convinced me of the neceſſity
" of placing all kinds of ſeeds at a certain
" depth in the earth, in order to their
" producing vigorous and healthful plants.
" For this wiſe purpoſe a variety of drill-
" plows have been invented and recom-
" mended; but, from the expence at-
" tending the purchaſe, and the extreme
" complication of their ſtructure, there is
" not

" not an inſtrument of that kind, as yet
" diſcovered, that is likely to be brought
" into general uſe.*

" When I ſpeak of the drill plow, I do
" not connect the idea of its working with
" the horſe hoe. I here conſider it only
" as an inſtrument for ſowing land in equidiſtant rows, which by opening a furrow, ſhedding the ſeed and covering it,
" leave the land ſtock'd with plants in the
" manner of broad caſt ſowing.

" Grain ſown by the hand, and covered
" by the harrows, is placed at unequal
" depths: the ſeeds conſequently ſprout at
" different times, and produce an unequal
" crop. When barley is ſown late, and
" a drought ſucceeds, the grain that was
" buried

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* This obſtacle is now entirely removed, as evidently appears from the moſt ſtrong and ſimple ſtructure of the machine, deſcribed in this publication, and which is adapted to the meaneſt capacity.

" buried in the moiſture of the earth ſoon
" appears, while ſuch as was left near the
" ſurface lies baking in the heat of the ſun,
" and does not vegetate till plentiful rains
" have moiſtened the ſoil. Hence an inequality of the crop, an accident to which
" barley is particularly liable. The ſame
" obſervations, but in a more ſtriking manner, may be made upon the ſowing of
" turnips. It frequently happens, that the
" huſbandman is obliged to ſow his ſeed
" in very dry weather, in hopes that rain
" will ſoon follow, and either rolls or covers it with a buſh-harrow. We will
" ſuppoſe that, contrary to his expectations,
" the dry weather continues, the ſeed, being near the ſurface, cannot ſprout without rain. The huſbandman is mortified at his diſappointment, but is ſoon
" ſatisfied, and made eaſy by a perfect acquieſcence in what he thinks is the will
" of Providence. The ſcourge that he
" feels muſt not be placed to the diſpenſation of Providence, but has its ſource

" in the ignorance of the man himſelf.
" Had he judiciouſly buried the ſeed in the
" moiſture of the ſoil, with the drill-plow,
" or harrowed it well with the common
" harrow, his ſeed would have vegetated
" in due ſeaſon, and bountifully repaid
" him for his toil.

" The man that expects the ſeed to vegetate
" by heat alone little knows the immutability
" of Nature's laws. Heat and
" moiſture, when combined, unfold the
" particles of matter cloſely connected in
" the ſeed, and, by a kind of fermentation,
" bring the living principle into action.

" The huſbandman that knows and ſtudies
" theſe divine truths, will often diſcover
" his want of ſucceſs in his want of
" knowledge. Such a man will never repine
" at Providence, but, amidſt the adverſe
" calamities of ſeaſons, will at all

" times look up to the Deity with comfort
" and ſatisfaction.

" Reflections upon this divine ſubject
" cannot be brought down to the level of
" vulgar minds. Modes more familiar
" will, in general, be better underſtood,
" and more agreeably received. All mankind
" are not philoſophers.

" In the year 1769 I prepared a fifteen
" acre cloſe for turnips. The land was in
" fine condition as to lightneſs, and had
" been well manured. On the 24th of
" June I ſowed fourteen acres of this field,
" broad caſt, and harrowed in the ſeed
" with a buſh harrow; the remaining
" acre I ſowed on the ſame day with the
" drill-plow, allowing fourteen inches between
" each row, and ſet the ſhares near
" two inches deep. At the time of ſowing,
" the land was extremely dry, which

" induced me to make the experiment " with the drill plow, knowing that I " could place the ſeed into the moiſture of " the ſoil. From the time of ſowing to " the 5th day of July we had a continual " drought, ſo that the broad-caſt ſeed did " not make its appearance till about the " 8th of that month, at which time the " drill turnips were in rough leaf, having " appeared upon the ſurface the ſixth day " after ſowing.

" In the drieſt ſeaſons, at the depth of " two inches, or leſs, we are ſure of finding a ſufficiency of moiſture to make the " ſeed germinate. When that is once accompliſhed, a ſmall degree of moiſture " will carry on the work of vegetation, " and bring the tender plant forward to " the ſurface.

" When extreme dry weather obliges " the broad-caſt farmer to ſow late, he has

" no opportunity of ſowing a ſecond time
" if the fly ſhould get in the field. The
" drill ſecures him, in ſome degree, a-
" gainſt that misfortune, by giving him
" a full command over the ſeaſons.

" I do not confine the excellence of the
" drill plow to turnip ſeed. It is an uſeful
" inſtrument for ſowing all kinds of grain.
" By burying the ſeed at an equal depth, it
" ſecures an equal crop in all circumſtances
" of the weather. But this is not the only
" conſideration to the cultivator; it ſaves
" near one half of the ſeed, which is an
" object of importance to the tillage far-
" mer. *

" In order to be clearly underſtood upon
" this ſubject, I beg leave to obſerve, that
I do

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* More than one half of ſeed wheat, in many inſtances, and five parts out of eight of ſeed barley is ſaved by the uſe of my machine, excluſive of the great increaſe of crops.

" I do not here recommend the drill-plow " as a good inſtrument for ſowing turnip- " ſeed, unleſs when the weather is ſo dry " and ſultry as to give the farmer reaſon to " apprehend danger from the late ſprout- " ing of the ſeed. When the weather fa- " vours germination, the broad-caſt me- " thod, by being moſt expeditious, and " leſs expenſive, is much more eligible.*

" When the farmer chooſes to introduce " the horſe-hoe,‡ the drill muſt then be

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* From the learned Doctor's obſervations on the extreme complication or the ſtructure of the drill-plows then uſed, it muſt be concluded, they were not capable of executing ſo expedioufly as mine, which, with a man, boy, and two horſes (even in the ſtrongeſt or ſtiffeſt ſoil) will completely drill from eight to ten acres a day, and at the ſame time cover the ſeed.

‡ A breaſt or running-hand hoe is now made of any ſize, as to ſuit the diſtance between the rows of corn, it cuts the weeds at the ſame time, and moulds up the rows of grain. One man can hoe from an acre to an acre and a half of light land, and from half an acre to an acre of ſtiff land, in a day.

" recommended in all ſeaſons, on account " of its diſtributing the ſeed in rows. " The ſhares muſt be placed deeper or " ſhallower, according to the drineſs or " wetneſs of the ſeaſon.

" Was I to give my opinion upon the " beſt method of raiſing turnips, I ſhould " not heſitate one moment to declare in favour of the drill and horſe-hoe, with intervals of three feet; but an enlargement " of this ſubject does not come within the " idea of the preſent eſſay, which only reſpects the drill-culture, in equi-diſtant " rows, independent of the horſe-hoe.

" Having ſufficiently enlarged upon the " neceſſity of lodging the turnip ſeed within the earth, during an extreme drought, " I ſhall now proceed to an experiment " made upon barley, with a view to recommend the ſowing of that grain, as

" well as all others, by the drill-plow, in
" preference to the cuſtomary method.

" In the ſpring of the year 1769, I
" ſowed an acre of barley, in equi-diſtant
" rows, with the drill plow, in a field
" which was ſown with the ſame grain,
" and upon the ſame day, broad caſt. The
" broad caſt took three buſhels per acre;
" the drill required only ſix pecks. This
" circumſtance is worthy obſervation. The
" drills were eight inches aſunder, and the
" ſeed was lodged about two inches with-
" in the ſoil. The drill acre was finiſhed
" within the hour, and the moſt diſtin-
" guiſhing eye could not diſcover a ſingle
" grain upon the ſurface.

" In the courſe of growing, the drill
" barley ſeemed greener, and bore a broader
" leaf than the broad caſt. When the ears
" were formed throughout the field, the
" ear of the drill barley was plainly diſtin-
" guiſhed

“ guiſhed to be near half an inch longer
“ than the broad caſt, and the grains
“ ſeemed fuller and better fed. This appearance occaſioned a general ſurpriſe,
“ and I confeſs I was at firſt at a loſs how
“ to account for this apparent difference.

“ Reflecting upon ſome experiments that
“ I had made upon the roots of wheat, I
“ was induced to dig up ſome roots of the
“ drill and broad caſt barley, and was moſt
“ agreeably ſurpriſed to find the cauſe of
“ the difference to be in the roots. The
“ pipe of communication between the ſeminal and coronal roots of the drill barley, was conſiderably longer than the
“ broad caſt. And upon that appearance
“ I was convinced that the length of the
“ ear, and the ſtrength of the ſtraw, principally depended.

“ I ſhall not here repeat what I have
“ formerly advanced upon the ſhape of the

" roots of wheat. The curious reader will
" find that ſubject clearly and ſatisfactorily
" explained in the firſt volume of theſe
" eſſays. Without an attention to this
" ſimple mechaniſm, it is impoſſible for
" the cultivator to have any adequate idea
" of the vegetation of corn. It is matter
" of ſurpriſe that ſuch a ſelf evident truth
" ſhould have hitherto eſcaped the obſerva-
" tion of naturaliſts. Upon it the doctrine
" of top-dreſſings depends. Every perſon
" knows their uſe, but few can explain
" the manner of their operation. But to
" return.

" The product of two hundred ſquare
" yards of the broad caſt and drill barley
" were carefully houſed, and afterwards
" thraſhed out. The drill exceeded the
" other nearly one fifth in meaſure, and
" being a bolder and better grain, weigh-
" ed heavier, at the rate of two pounds in
" the buſhel.

" From the experience that I have had " of the drill ſowing, I can recommend it " as a moſt rational and judicious practice. " But as it has many difficulties to over- " come, I apprehend it never will be " brought into general uſe. A proper in- " ſtrument is wanting that would come " cheap to the farmer, and have the re- " quiſites of ſtrength and ſimplicity to re- " commend it. The preſent inſtruments " cannot, by any means, be put into the " hands of common ſervants. Should we " ever be ſo happy as to ſee this objection " removed, it is probable that all kinds of " grain will be cultivated in drills.* Corn " growing in that manner has a freer en- " joyment of air, and the farmer has an

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* I muſt again beg leave to repeat, that my Machine has the requiſites of ſtrength, that nothing but the greateſt violence can injure it; and its ſimplicity is ſuch, as to be in a few minutes perfectly underſtood by any perſon of the loweſt capacity.

" opportunity of hand hoeing and weed-
" ing without injury to the growing crop.
" This is an object of the utmoſt conſe-
" quence in the cultivation of beans and
" winter corn.

" Wheat placed into the earth by the
" drill plow, is not liable to be turned out
" after froſts: The ſeminal root ſerves the
" purpoſes of an anchor. This is a con-
" ſideration of great conſequence to the
" farmer.

" Much more might be advanced upon
" this curious and intereſting part of Agri-
" culture. But I flatter myſelf that thoſe
" looſe thoughts will be the means of
" awakening the attention of others, who
" have more leiſure and greater abilities
" than I have.

" After what I have advanced it will be
" needleſs to obſerve, that in this eſſay I
" only

“ only mean to recommend the drill plow for ſowing the land in equi-diſtant rows, inſtead of diſtributing the ſeed by hand in the manner called broad caſt. The drill, when connected with the horſe-hoe, conſtitutes quite a different ſyſtem, which has great merit when judiciouſly conducted.

“ It will not be improper to obſerve in this place, that moſt gentlemen who have favoured the public with comparative experiments, between the drill in equi-diſtant rows, and the broad caſt, or old method, have choſen an improper diſtance between the rows, and by that means rendered their comparative trials inconcluſive. A foot is the diſtance generally taken, which, beyond doubt, will not only encourage the growth of weeds, but alſo prove a conſiderable loſs of land. The diſtance ſhould never exceed eight or nine inches, and then the

" comparative trial would be concluſive, as
" both methods are ſuppoſed to be conducted in the moſt perfect and advantageous manner."

Dr. Hunter's Georgical Eſſays. V. III. P. 28.

EXPERIMENTS

ON

DRILLING GRAIN.

BY

M. LULLIN DE CHATEAU-VIEUX,

First Syndic of the City and Republic of
Geneva, in the year 1752.

On fields ſown in equi-diſtant rows with the drill plow.

" I HAVE ſowed fields cultivated in every
" reſpect in the common way, ex-
" cept in the manner of diſtributing the

" ſeed, which was done with the drill
" plow. The whole field was covered
" with rows of wheat, diſtant from each
" other ſeven inches and an half.

" The advantages I propoſed to myſelf
" by ſowing in this manner, were, firſt,
" the ſaving of ſeed and preventing the
" earth from being overſtocked with
" plants: ſecondly, burying the ſeed at a
" proper depth: thirdly, having the plants
" at equal diſtances: and laſtly, the little
" ſtirring of the ground and breaking of
" the clods, which the drill plow effects
" at the ſame time that it ſows. Theſe
" things ſeemed to me more likely to be
" attended with ſucceſs, than the common way of ſowing.

" The plants of this wheat were very
" fine: their deep green colour ſhewed
" their ſtrength: the largeneſs of their
" blades, and the number of their ſtalks,
" ſhewed

" ſhewed likewiſe that they found greater " plenty of nouriſhment than wheat in " the common way. The plants had, in " general, four, ſix, eight, ten, or more " ſtalks; ſo that theſe fields, which, 'till " the month of April, ſeemed ſcarcely to " have been ſown, changed then ſo as " hardly to be known again, by the number of ſtalks which ſhot forth at that " time. The wheat was taller than that " in the old way, and the ears larger and " better fill'd with grain.

" An account of the produce will ſhew " what may be expected from this manner " of ſowing.

" Account of the produce of the ſame " field ſowed part in the old way, and " part with the drill plow, the fourteenth, " fifteenth, and ſixteenth of September, " 1751.

“ The whole of this field uſed commonly to be ſowed with twenty meaſures of wheat, each meaſure containing one hundred and ſix pounds of eighteen ounces. Three meaſures, or three hundred and eighteen pounds of wheat, were ſown in the uſual way in the richeſt part of the field. The remaining part was ſowed with the drill plow, with only two hundred and ſixty-five pounds of wheat, which in the common way would have required one thouſand eight hundred and two pounds.

“ The ſoil was middling, neither too ſtrong nor too light, and pretty ſtony. The land was poor, becauſe it had not been dunged; which indeed it ſeldom was, the owner not having more than was neceſſary for his vines.

“ Produce of the new Huſbandry.

		lbs.	lbs.
“ The 265 lbs. of wheat “ produced - -			5450
“ To be deducted,			
“ For ſmall and bad grain “ ſifted out 4 per ct.		218	
“ For the ſeed, - - -		265	
			483
“ Neat produce,			4967
“ If the other part of the “ field, which was “ ſowed with the 3 “ meaſures in the “ old way, had been “ ſown with the drill “ plow, it would “ have yielded -		960	
“ To be deducted,			
“ Loſs by ſifting 4 “ per cent.	38		
“ For the ſeed, -	46		
		84	
“ Neat produce to be added “ to the above,			876
“ Neat produce of the whole,			5843

" Produce of the old Huſbandry.

" That part of the field which was ſowed with the three meaſures of one hundred and ſix pounds each, produced thrice that quantity of ſeed, mixed with bad grain. The ſame meaſure of this grain weighed but one hundred and three pounds. This field yields no more even in the beſt years. If the whole of it had been ſowed in the old way, it would have produced

		lbs.
		6180
" To be deducted,		
" Loſs by ſifting, 15 per cent. it has often been 25lb. and 30 per cent. - -	lbs. 927	
" For the ſeed, - - - -	2120	3047
" Neat produce, - - - - - -		3133
" Balance in favor of the new method		2710
		5843

Duhamel's Huſbandry, page 157.

It is to be remarked, that from all M. DE CHATEAU-VIEUX's reports, that the lands about Geneva appear to be extremely poor, conſequently very badly adapted for wheat. Other numerous experiments were tried by this ingenious Agriculturiſt, all which clearly prove the great and ſuperior advantages of the drill huſbandry over the common method of broad caſt ſowing.

And as I wiſh to make this publication as ſhort as the ſubject can poſſibly admit of, will only beg leave to quote M. DE CHATEAU-VIEUX's recapitulation of one part of his experiments, referring thoſe who may be deſirous of further information to conſult DUHAMEL's Huſbandry, where many others, equally intereſting, may be ſeen.

" RECAPITULATION.

“ RECAPITULATION.

“ WE have ſeen a very conſiderable ex-
“ periment repeated three years running,
“ and always attended with great ſucceſs.
“ I ſhall now ſum up the eſſential and de-
“ ciſive facts, which are ſo many unex-
“ ceptionable witneſſes, who depoſe, That
“ it is much more profitable to ſow lands
“ with the drill plow, than to ſow them
“ in the common way.

“ To this end, I reſume the neat pro-
“ ducts of the crops.

" New Huſbandry.

" Neat produce of three Farms.

	lbs.
" In 1754, - - - - - - -	93418
" 1755, - - - - - - -	120702
" 1756, - - - - - - -	111738
" Total neat produce of 3 years,	325858

" Old Huſbandry.

	lbs.
" 1754, - - - -	62200
" 1755, - - - -	50516
" 1756, - - - -	55200
" Total neat produce of 3 years,	167916

" The difference in favour of " the new huſbandry, in 3 " years, amounts to - -	157942

" This is an object of great importance, " not only to the public, whoſe welfare

“ it highly concerns, but to every owner “ of land. How ſtrongly does it ſhew the “ vaſt advantage of the drill huſbandry! “ We here ſee one hundred and fifty arpents of land produce one hundred and “ fifty-ſeven thouſand nine hundred and “ forty-two pounds of wheat more than “ they would have done without this fa-“ vourable culture.

“ Any one may eaſily reckon the value “ of ſuch a quantity of wheat, ſuppoſing “ it to be of the very beſt ſort, as in fact “ it was.

“ Reckoning the Engliſh buſhel at ſixty-two pounds, theſe one hundred and “ fifty-ſeven thouſand nine hundred and “ forty-two pounds will exceed three hun-“ dred and twenty quarters of wheat. Be-“ ing the ſuperior produce of the new to “ the old huſbandry.

Duhamel's Huſbandry, page 278.

EXPERIMENTS
ON
DRILLING BARLEY.

COMPARATIVE VIEW OF TWO CROPS OF BARLEY;

One drilled, and the other ſown broad-caſt, in the ſame Field.

BY

Sir JOHN ANSTRUTHER, Bart.

" GENTLEMEN,

" I Herewith ſend you an account of an
" experiment made to aſcertain the
" produce of drilled barley, compared
" with broad caſt; they were ſown on

" the ſame field, and at the ſame time, " and there was no apparent difference in " the ſoil.

" You may depend on this account be- " ing perfectly juſt.

" The drills were eighteen inches wide, " and the grain was dropped by hand, the " expence of which was three ſhillings and " three-pence per acre.

" The ſeed drilled was one buſhel and " three gallons per acre. The produce " was fifty-ſix buſhels and three gallons " per acre.

" On the broad-caſt part the ſeed ſown " was three buſhels and five gallons per " acre. The produce only thirty-ſix " buſhels and five gallons per acre.

" Extra produce of the drilled crop about twenty buſhels per acre, beſides
" near two buſhels of ſeed ſaved.

" London,
" February 10, 1786."

Bath Soc. Pap. Vol. III. p. 390.

EXPERIMENTS
ON
DRILLING GRAIN.

WILLIAM WHITMORE, of Dudmaſton, near Bridgnorth, Shropſhire, Eſq. in his letter, dated December 29, 1784, to Owen Saluſbury Brereton, Eſq. V.P.F.R. and A.S. Soho-ſquare, did not heſitate to decide greatly in favour of the drill ſyſtem, when properly underſtood; and would venture to affirm, that ſhould ever that method be generally purſued, it would ſoon prove a great national advantage.

That the ſoil on which he began to uſe the drill-plow was a good hazle loom, a ſpade's depth, having a ſandy, gravelly bottom; that in the year 1783 it produced a large crop of turnips, after proper preparation of fallowing, mucking, &c. were eat off the premiſes by ſheep the ſucceding ſpring; when it was twice plowed, and in the middle of April, ſix ſtatute acres of barley, and two of ſpring wheat were planted in equi-diſtant drills of eighteen inches, taking ſomething leſs than a buſhel of ſeed to each acre; that as ſoon as the grain was completely up, and weeds appeared, had the crop well hoed, and ſuch hoeing again repeated on the ſecond appearance of weeds, which made the crop grow ſo vigorous, that the intervals between the drills were hardly diſcernable. That the exceſſive heavy rains which fell laſt ſummer injured many ſtrong crops; that the above crops, though frequently lodged, roſe again with great vigour; that his neighbours, who had reprobated his method of proceeding, and ridiculed the folly of ſowing ſo ſmall

a quantity

a quantity of ſeed, found their prediction of ſo ſmall a crop prove the reverſe, for the return was upwards of ſixty buſhels, Wincheſter meaſure, of barley, and thirty buſhels of ſpring wheat to the acre. That the moſt favourable and rich ſpots in theſe environs would not produce, by any broadcaſt ſowing, above fifty buſhels of barley; and that this ſyſtem, excluſive of a large crop, has, in reſpect of ſaving of ſeed, evidently the advantage, not only in regard to general benefit, but even individually ſo, in point of œconomy, the two hoeings being well performed for three ſhillings per acre. In reſpect to wheat, twenty five buſhels is reckoned a fair crop in the beſt diſtricts; and that more than thirty buſhels of winter planted corn may be expected by this proceſs; and that forty and fifty buſhels had been produced when planted in equi-diſtant rows of one foot.

Tranſ. of Lond. Soc. for Encourag. of Arts, &c. Vol. IV. p. 10.

ON

DRILLING GRAIN.

(By Mr. MILLER.)

MR. MILLER was fully convinced of the ſuperior advantages of drilling grain to the common method of broad caſt ſowing. He ſays, " I have ſeen ex-
" periments made by ſowing barley in
" rows a-croſs divers parts of the ſame
" field, and the rows a foot diſtance.
" The intermediate ſpaces of the ſame
" field were at the ſame time thrown
" broad caſt in the uſual way. The ſuc-
" ceſs was this: the roots of the drilled
" tillered out from ten or twelve to up-

“ wards of thirty ſtalks on each root; the
“ ſtalks were ſtronger, the ears longer,
“ and the grains larger than any of thoſe
“ ſown in the common way; and when
“ thoſe parts of the field, where the corn
“ ſown in the uſual way has been lodged,
“ thoſe parts ſowed thin have ſupported
“ their upright poſition againſt wind and
“ rain. Though the rows have been made
“ not only length ways, but croſs the
“ lands in ſeveral poſitions, ſo that there
“ could be no alteration in regard to the
“ goodneſs of the land, or the ſituation of
“ the corn. Therefore, where ſuch experiments have been frequently made,
“ and always attended with equal ſucceſs,
“ there can be no room to doubt which of
“ the two methods is more eligible, ſince,
“ if the crops were only ſuppoſed to be
“ equal in both, the ſaving more than half
“ the corn ſown is a very great advantage,
“ and deſerves a national conſideration, as
“ ſuch a ſaving, in ſcarce times, might be
“ a very great benefit to the public.

“ I know

" I know the farmers in general are very
" apt to complain if their corn does not
" come up ſo thick as to cover the ground
" green in a ſhort time, like graſs fields.
" But I have often obſerved, that when,
" from the badneſs of the ſeaſon, it has
" come up thin, or by accident has been
" in part killed, their corn has been
" ſtronger, the ears longer, and the grain
" plumper; ſo that the produce has been
" much greater than in thoſe years when
" it has come up thick; for the natural
" growth of corn is to ſend out many
" ſtalks from the root; therefore it is en-
" tirely owing to the roots ſtanding too
" near each other when the ſtalks are
" drawn up tall and weak. I have had
" eighty-ſix ſtalks upon one root of bar-
" ley, which were ſtrong, produced longer
" ears, and the grain was better filled than
" any I ever ſaw grow in the common
" method of huſbandry; and the land
" upon which this grew was not very rich.

“ But I have frequently obſerved, on the
“ ſides of hot-bedsin the kitchen-gardens,
“ where barley ſtraw has been uſed for
“ covering the beds, that ſome of the
“ grains left in the ears have dropped out,
“ and grown, the roots have produced
“ from thirty to ſixty ſtalks each, and thoſe
“ have been three or four-times larger
“ than the ſtalks ever arrive at in the com-
“ mon way.

“ The noblemen and gentlemen, in
“ France, are very buſy in ſetting ex-
“ amples of this huſbandry in moſt of their
“ provinces, being convinced of its great
“ utility by many trials; and it were to
“ be wiſhed the ſame was done in En-
“ gland.”

OF

HOEING.

HOEING is the breaking or dividing of the ſoil, by plows or other inſtruments, while the corn or plants are growing thereon.

When ſtiff land is not hoed, it will ſoon coaleſce, and continue conſolidating till it acquires the ſame ſolidity that it had before it was cultivated; of courſe the dews and rains cannot freely penetrate to the roots of plants, but will either remain on the ſurface, be exhaled by the heat of the ſun, or conveyed off by the leaſt current or declivity; or the ground will be ſo thoroughly ſoaked with, and retain the rain ſo much longer than hoed land, that the water will rather chill than nouriſh the plants depoſited therein.

A ſtiff ſoil will become ſo hardened, after the water is exhaled out of it, that it cannot receive any benefit from the air or other atmoſpherical influences, and will prevent the roots and tender fibres of plants from penetrating and extending themſelves in ſearch of food when they moſt want it. Weeds, as being of a much hardier nature than plants, will thrive with leſs ſupplies, and grow ſo vigorous, as often to ſtifle and rob them of great part of that food the ſoil before allowed them. Hence, inſtead of a plentiful, a ſcanty crop is obtained.

By the old or common mode of huſbandry, the whole tillage is given to the crop at the time of ſowing or planting, without any farther proviſion being made, while the plants are advancing to maturity.

Hoeing is always practiſed by gardeners, and proved to be of the greateſt utility in promoting the growth of all vegetables; if therefore ſo advantageous in the garden, why ſhould it not be as beneficial in the field? Certainly, corn and pulſe are as uſeful to the community as any vegetables a garden can produce.

The advantages reſulting from hoeing are great and many. Facts are the ſtrongeſt proofs, and ſuch convincing arguments as cannot be refuted. Corn and pulſe, when drilled at any diſtance, from ſix to twelve or more inches, may be hoed with a breaſt or running hoe, made of ſuch a ſize as to cut the weeds, pulveriſe the ground, and add freſh nouriſhment by raiſing the earth to the plants without cutting them. In light land, a man can with eaſe hoe an acre and a half in a day, between corn drilled at ſix inches, which experience teaches me is the moſt advantageous diſtance for producing the greateſt crops.

By hoeing, weeds are deſtroyed, freſh earth is added to ſupport the crop, the ground is ſo pulveriſed as readily to imbibe the dews and rains, and in the drieſt ſeaſons plants are kept in a moiſter ſtate than in land that is not hoed.

That tilled earth receives advantages from dews, which the untilled does not, is in the power of any perſon to be convinced of. In the month of July, or any other when the ſeaſon is drieſt, dig a yard ſquare of a bed in a garden that had been tilled in February or March; after five or ſix days, examine the tilled and untilled parts; the earth in that part freſh dug will be found moiſt, while the remainder of the bed not dug, will be found dry. It is juſt the ſame with tilled fields; one part of a field, made fine by frequent plowings, will in dry weather turn up moiſt, while the other part of the ſame land, that had been left rough, and not ſufficiently plowed, will be dry.

When land is pulveriſed by hoeing, the air has free acceſs to the roots of plants, whoſe tender fibres may then readily extend themſelves to receive their nouriſhment, at ſeaſons when they ſtand moſt in need of it. Hoeing alſo prevents the ſoil being long ſoaked with rain, which freely paſſes through the looſened earth, and the dews never ſuffer it to become perfectly dry; and by hoeing the ground is partly prepared for a ſucceeding crop.

Another demonſtration of the great utility of hoeing muſt appear extremely ob vious to every perſon. Were gardeners who pay from three to four pounds pe acre for their ground, to plant vegetable without hoeing them, the natural produc woul would not pay the expences of ſeed and gathering, excluſive of the expences of tillage and rent; and the gardens would ſoon become a perfect wilderneſs.

OF

ROLLING.

ROLLING is the operation of drawing a roller over the ſurface of the land, to break the clods, and render it ſmooth.

Old paſtures, as ſoon as broken up, clover, and all other vegetables when plowed in as manure, ſhould be immediately rolled to cloſe the earth, which will cauſe a ſpeedy fermentation, rot the ſward, and ſoon convert vegetables into a fertilizing manure. Rolling is alſo of great utility on lawns and walks. It hardens the ground, and thereby prevents the free acceſs of air to the roots of graſs, which conſequently cannot grow ſo luxuriant; and by being levelled, the walks are the cloſer and eaſier mowed:—Thoſe are the only advantages that appear to me from rolling.

Experience has inſtructed me, that rolling paſtures, meadows, and grain, (even when moſt judiciouſly performed) is injurious; particularly on ſtiff and loamy ſoils, which become ſo hardened and bound, that the roots of vegetables are excluded from the benefits of the air, and the land thereby rendered impenetrable to dew and rain, which run off, or are exhaled. And every experiment I have made on graſs and corn, even in light ſoils, has convinced me that (particularly where corn is depoſited at a certain depth by drilling) rolling and the treading of the horſes, adds tenacity; and prevents the roots of vegetables from extending themſelves in queſt of nouriſhment. The intent of plowing is to looſen and pulveriſe; rolling counteracts that operation, and undoes what had before been done; whereas harrowing looſens the hardened, turf-bound ſoil; admits the free acceſs of air and benefit of manure to the roots of plants, by which a much more plenteous crop is obtained.

EXPERIMENTS

Made to endeavour to aſcertain the moſt profitable METHOD of applying POTATOES to the rearing and fattening HOGS.

AS ſwine are one of the moſt increaſing, profitable, and ſagacious* ſpecies of animals that can be kept on a farm, they moſt deſerve the huſbandman's particular attention.

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* I have obſerved the ſagacity of ſwine to be equal to that of any domeſtick animal. The too general barbarous treatment of kicking and beating them, as if inanimate beings, only tends to make them vicious and furious. I do not permit

From experience, I have found that ſwine prefer lucerne to clover. Laſt year I had a ſmall ſpot of lucerne adjoining to a field of clover, to both which they had free acceſs. When drove into the clover,

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mit any of my ſwine to be in the leaſt abuſed, but give every encouragement to have them gently treated. By this mode, they will follow the boy who feeds them, like ſo many dogs; and will, even in the open field, lay themſelves down to be ſmoothed and played with.

One of my labourers living near me, was lately employed on a common in front of my houſe. I obſerved his pig grazing near him all the morning. When the man went to dinner, the pig followed him: which induced me to be very attentive; and I found that the pig continued grazing within ten yards of him the whole day. On enquiry, I was informed that he had not purchaſed this pig more than a fortnight before, when he was ſo unmanageable, that it was with difficulty he could drive him home; and that according to his uſual method of the moſt gentle treatment, the man found that pigs could be ſo tamed, as to follow him wherever he would permit them.

they would immediately return to the lucerne, which manifeſtly proves it to be a ſweeter feed for ſwine. The ſuperior advantages of lucerne to clover, are great and many. Lucerne is not only earlier, and much more luxuriant in its growth, but will bear cutting four times in a ſeaſon, and likewiſe flouriſh from fourteen to ſixteen years longer than clover. The manure dropt by the pigs, tends greatly to enrich the land it grows on: hence I am fully convinced of its ſuperior advantages to every other culture.

I have experienced, that neither lucerne nor clover are of themſelves a ſufficient ſupport for the large Shropſhire breed of ſwine. A ſmall quantity of corn, peaſe, or beans, (particularly in cold mornings) is eſſentially neceſſary to be given them, before they are turned out. Such food will warm and ſtrengthen their ſtomachs, and prevent the bad conſequences of a diſorder

order generally called (in this part of the country) *the blood*;† which, from the following circumſtance that occurred to me laſt April, I conſider as an erroneous appellation.

My ſwine's feeding ſo heartily on lucerne and clover, prevented my bailiff's giving them any corn for ſome mornings. Soon after, I was informed that one of my pigs, near four months old, was affected with a diſorder called *the blood*. I immediately attended, found the pig extended on the graſs, in rather an inſenſible ſtate, with its dam near it, in a ſeeming condolent manner, bewailing the ſituation of its offſpring. I ordered the pig to be put on its legs; it hung down its head, ſtaggered, and again laid down. Its belly appeared to be full, and as my people aſſured

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† Deſcribed to me, to be the overflowing of the blo to the heart or head, where its circulation is impeded.

ured me it was *the blood*, according to the general cuſtom practiſed in this part of the country, its tail was cut, which bled a little. I had it carried to the ſtye, where it was followed by the dam. Then I ordered ſome barley-meal to be immediately ſcalded, and mixed with milk, which it would not eat, nor could any quantity be conveyed into its ſtomach by drenching. I tried ſeveral other methods to relieve it, but ineffectually. In a few hours after it died. From the appearance of its belly being full, I ſuſpected it muſt have eaten ſome poiſonous weeds, or ſwallowed ſome venemous inſect; curioſity induced me to examine its viſcera, and with all poſſible circumſpection, I firſt had its diſtended ſtomach opened, which contained only an elaſtic air, and a very ſmall quantity of the meal, and milk which was curdled. I took the ſame precaution in having its inteſtines opened, all which contained nothing but the ſame elaſtic air as the ſtomach.

mach. All its viſcera were perfectly ſound.

Hence, after the moſt minute inveſtigation, I found that the diſorder proceeded, not from the overflowing, but from the real want of a ſufficient quantity of blood, ariſing from the want of ſolid nouriſhing food.

To prevent the other pigs being ſimilarly attacked, I loſt not a moment's time in preparing ſcalded barley-meal, which was mixed with milk, and given them blood warm, with a ſmall quantity of ſpirits of hartſhorn; at firſt, I fed them but ſparingly, and by degrees increaſed their quantity of food, till I thought them out of danger. Every morning after, I had them fed with corn before they were turned out; by this precaution they throve well.

Hence, I am fully convinced, that lucerne or clover, without the aſſiſtance of ſome ſolid food, is not ſufficient to ſupport and nouriſh large ſwine; and that the diſeaſes they are ſubject to, chiefly ariſe from improper, unwholſome food, ſuch as damaged fuſty grain, (too frequently given them) or common dirty waſh, or the ſtale offal of the garden, which in general is eſteemed good enough for pigs.

I have applied potatoes in different modes for feeding ſwine; given them whole, or maſhed in the water wherein they were boiled; or the laſt mode with barley-meal† ſcalded and mixed in the trough. But from various and repeated experiments, I have found the following the moſt profitable method of applying potatoes, to not only the *rearing*, but likewiſe to *fattening* of hogs; varying the quantity given according to the circumſtances of rearing, or fattening.

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† Whole peas, beans, or any grain, frequently paſs through hogs in an indigeſted ſtate, therefore ſhould always be ground.

When rearing, a ſmall quantity of food given once or twice a day, with lucerne, clover, graſs, and offals, is ſufficient.

When fattening, a conſtant ſupply is eſſentially neceſſary, ſo as not to leave the troughs encumbered with ſtale meat, which ſhould be cleared out, and given to ſtore ſwine.

An iron furnace is the moſt ſalutary for boiling potatoes. Should time or conveniency not permit to have it emptied for ſeveral days, no bad conſequences can enſue.

Copper, or copper and lead, are extremely dangerous, as they generate poiſon;

ſon; therefore, they ſhould be immediately emptied and cleaned.

The method I have lately adopted, and always ſhall purſue, until a better be pointed out, is, to fill about three parts of a furnace with potatoes; when in proportion to every five buſhels of potatoes, I ſcatter over them about a peck and a half of barley-meal, then fill the furnace with potatoes, adding juſt as much water as will cover them. By this method, the barley-meal does not ſink to the bottom of the furnace, where it will encruſt and burn, nor will it be liable to be waſted by being boiled over. The nouriſhment of the barley is in a great degree extracted by the water, and after the potatoes are well boiled, let the whole be mixed and bruiſed together in tubs, with a clean ſpade, ſo as to form a pulp. By this method, all the nutritive properties of the barley and potatoes are incorporated, and thereby much eaſier digeſted. Broths and ſoups are never made but by boiling the meal or ingredients in the water. Were the different articles to be mixed with boiled or ſcalding water only, their nouriſhment could not be extracted, conſequently would be very inſipid, and not ſo nutritive. By this mode, the hogs require no water. In cold weather their food ſhould be given blood warm. My barley, which was ſtained by the inclemency of the ſeaſon in 1785, I had ground, and uſed for this purpoſe; which prevented my purchaſing *gurgians*, which is nearly, if not equally as nutritive as barley-meal, and much cheaper.

Swine, when fattening, ſhould be kept as clean as poſſible, and well ſupplied with dry litter. As their pens are generally too ſmall to admit of exerciſe; and as they immediately lie down after feeding, I have thought it neceſſary, twice or three times a week, to add about three table ſpoonfuls of ſalt to a half buſhel pail of food; which aſſiſts digeſtion, conſolidates their food, and increaſes their appetites. When too great a quantity of ſalt is given, it then acts as a purgative, which prevents their food conveying the neceſſary nouriſhment.

About once a week I have mixed two ſpoonfuls of madder, which prevents obſtructions, acting as a diuretic, and is at the ſame time an aſtringent. And on ſome other day in the week I give a ſpoonful or two of an equal quantity of flowers of ſulphur and ſalt-petre, well pounded and mixed; which purifies and cools the blood. All theſe different articles, added to each pail of food in the morning, on ſeparate days, entirely prevent the meazles, keep the ſwine extremely healthy, and fatten them more expeditiouſly.

When ſome of my hogs were firſt penned up, they were affected with a violent cough, vulgarly called the *buſk*; which the above ingredients entirely removed in a very ſhort time.

It frequently happens, that ſwine are killed when diſordered with the meaſles, which is eaſily diſcovered by the meat or fleſh containing ſmall globular red or white puſtules of different ſizes, varying according to the different degrees of the diſeaſe; which originates from their being fed with fuſty damaged corn, or ſome unwholſome food; or from their being boiled in lead and copper veſſels, in which it has lain too long; or from their being kept in a wet or dirty pen: either of which cauſes, tends to obſtruct the free circulation of the fluids; hence ariſe thoſe globular puſtules, which are the juices rendered viſcid and coagulated.

The different articles that I have as above pointed out, will entirely remove ſuch obſtructions; purify and promote the circulation of all the fluids; and tend greatly to expedite the fattening of hogs.

I muſt farther obſerve, that hogs, from the age of twelve to eighteen months, are the moſt advantageous to be fed for bacon, as they have then attained their full growth, will require leſs food, and fatten much more expeditiouſly than hogs that are younger.

Experiments on Porkers.

Expences on Pigs, purchaſed March 17, 1785.

	£.	s.	d.
Paid P. Highman, for 5 porkers,	3	12	6
Expences at, and driving from market, - - - - - - -	0	1	3
Six buſhels of barley (tailings) and grinding, - - - -	0	16	6
Coal, - - - - - - - - -	0	1	3
Forty-buſhels of potatoes, -	0	7	6
£	4	19	0

Pigs ſold in April, 1785.

Ap.		*Score.*	*lbs.*
21.	Two to William Hughes,	5	7
28.	Three ditto, - - - - -	10	6
	Total - -	15	13

	£	*s.*	*d.*
At 6s. 6d. per ſcore,	4	19	0

OBSERVATIONS.

The potatoes were unſizable for the Briſtol market, as being the largeſt and ſmalleſt. They were put out of the furnace into tubs, and the barley-meal given promiſcuouſly with the potatoes, without being maſhed. I could have ſold thoſe unſizeable potatoes at eight-pence per buſhel in the country; but by this mode of application I was only paid two-pence per buſhel, and two-pence over on the whole. Hence, I am convinced, young porkers

will

will not pay for being fattened with potatoes, by this method.

Experiment on Bacon Hogs.

Hogs varrowed. { 6, *Jan.* 14, 1785.
9, *Feb.* 17.

1785.		*Hogs.*
Nov. 9.	Penned up to fatten,	12
16.	Ditto, - - - -	2
De. 26.	Ditto, - - - -	1
		15

	£	*s.*	*d.*
* Valued at - - -	15	0	0
Coal, - - - - - - - -	0	11	6
14 buſh. barley (ſtained) at 3s.	2	2	0
Carried over, - £	17	13	6

Brought

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* Theſe hogs were driven to Briſtol market the 27th of October, when I was offered no more than eighteen ſhillings each for them. I have valued them at twenty ſhillings each.

	£	s.	d.
Brought over, - - - -	17	13	6
Grinding the barley, - - -	0	3	6
1½lb. madder 13½d. ſalt 4s. 6d.	0	5	7½
Flowers of ſulphur & ſalt-petre,	0	1	1
306 buſhels unſizable potatoes, which is rather more than 14d. per buſhel, - - - - - - -	17	17	9½
	£ 36	1	6

HOGS *ſold.*

1785-6.		Score.	lbs.
Dec. 7.	Two to W. Hughes, -	13	0
28.	Three to Ditto, - -	22	0
31.	Three to S. Collard, -	23	11
Jan. 4.	Three to A. Parker, -	20	16
12.	Three to Ditto, - -	22	12
Feb. 10.	One to Ditto, - -	9	1
	Total - -	111	0

	£.	s.	d.
At 6 s. 6 d. per ſcore, -	36	1	6

OBSERVATIONS.

The beſt ſeaſon for purchaſing hogs at the Briſtol market, is about the latter part of October or beginning of November, when the milk ſeaſon is expired, and all the corn fields gleaned. Therefore, I could have bought hogs of the ſame ſize as above, at the time mine were offered for ſale, for about eighteen ſhillings to not exceeding nineteen ſhillings.

My hogs were only nine and ten months old when put to fatten; had they been full grown, I am convinced they would have paid much more than fourteen-pence per buſhel for the potatoes they ate.

The potatoes were of the Surinam ſort, and entirely unſizable for the Briſtol market, as being the ſmalleſt and largeſt. Moſt of the laſt ſort were watry and hollow, weighing from one pound and a half to three pounds; worth (if ſold in the country) from ſeven-pence to not exceeding eight-pence per buſhel.

The barley being ſtained, malſters and diſtillers refuſed to purchaſe it; and the higheſt price offered me for it was three ſhillings per buſhel, for the purpoſe of fattening hogs.

I could have purchaſed gurgians at two ſhillings and three-pence per buſhel, which I apprehend would nearly, if not equally, have been as nutritive as barley-meal; and thereby enhanced the value of the potatoes more than a half-penny per buſhel. Fourteen Shillings being the difference of the coſt of barley meal and gurgians.

Hogs that are full grown yield a greater profit in feeding than ſmaller ones; they alſo increaſe more in weight, and eat leſs food in the laſt month or ſix weeks of their fattening; and, during that time, a gradual increaſe of meal ſhould be added to the potatoes.

I have omitted making any charge for attending theſe hogs, as I deem the manure they have made equal in value to ſuch expence.

EXPERIMENTS
ON
TURNIPS.

Firſt Experiment.

AS turnips are the baſis of agriculture in many parts of this kingdom, particularly on light ſoils; and as the fly too frequently deſtroys the young plants before they grow into rough leaf, by which the induſtrious farmer is materially injured, being ſometimes obliged to ſeed the ground three times, and at laſt diſappointed of a crop for the ſupport of his ſheep in the ſucceeding ſpring. Therefore, in order to find out a remedy, for the preſervation of ſo uſeful a vegetable, I made ſuch experiments as I deemed moſt convenient for any farmer to put in practice.

On the eleventh of May, 1786, I ſowed early Dutch turnip-ſeed on a bed in my kitchen garden, in drills twelve inches diſtant from each other, near two inches deep. This bed had been manured with rotten dung in 1785; afterwards planted with cabbages. The ſoil a ſtiff loam. The ſeed was ſteeped or mixed with ſundries, as under, ſix hours before ſowing, and each drill marked with ſtakes: Viz.

No.

1. Seed, without any preparation.

2. Dry ſeed mixed with ſoot.

3. Ditto ſteeped in Barton draining.

4. Ditto, water out of dunghill.

5. Steeped ſeed, with ſtale human urine.

6. Ditto, lime and Barton draining.

No.

7. Steeped ſeed, with ſoot and water.

8. Ditto, ſoot and Barton draining.

9. Ditto, elder-leaf juice.

10. Ditto, elder-leaf juice and Barton draining.

11. Soot ſowed over the covered drills.

12. Lime ditto.

13. Seed mixed with ſlaked lime.

14. Scattered ſoot over, then covered.

15. Scattered lime over, and then covered.

16. Elder buſh drawed over the plants.

17. Seed, ſteeped ſix hours in train oil.

18. Ditto, in linſeed oil.

The linſeed oil was taken out of a bottle, that had contained oil of turpentine, for painters uſe.

Examined on the 26th of June, and remarked as under: Viz.

No. 17 and 18 were far ſuperior to the others.

No. 4, 7, 8, and 10, ſecond beſt.

No. 2, 9, 11, 12, 14, third beſt.

No. 6. no vegetation.

No. 5, 13, and 15, very few plants appeared.

No. 16, ſame as No. 1, which, with all the others, were inferior to the third beſt.

The fly appeared on each experiment, but did no real injury to No. 17, which grew ſo luxuriant as to produce rough leaves ſeveral days prior to the moſt flouriſhing of the others, and ſo continued to maturity. The leaves of No. 17, in particular, appeared to be fat, and twice as thick and ſtrong as any other, except No. 18, 18, that was very little inferior; which I preſume might have been owing to the ſmall mixture of the oil of turpentine that remained in the bottle.

Second Experiment on Turnips.

On the 20th of June, 1786, I drilled green Norfolk turnip-ſeed, near two inches deep, at one foot diſtance in the rows, on beds, eight feet three inches long, and two feet wide. The ſoil a ſtiff unmanured loam, in the corner of a field, fronting the ſouth; it had been Winter and Summer fallowed to the time of ſowing. Weight of the ſeed half a drachm to each bed, mixed or ſteeped with ſundry articles as follows: in order to endeavour to aſcertain the moſt effectual remedy for preventing the fly deſtroying the plants. All the different experiments were mixed with a pint of ſifted earth, immediately drilled, and marked with ſtakes: as follows:

No.		
1.	Mixed with ſoot,	$\frac{1}{2}$ an oz.
2.	Soapers aſhes,	ditto.
3.	Wood aſhes,	ditto.
4.	Pounded gunpowder,	ditto.
5.	Brimſtone,	ditto.
6.	Slaked lime,	ditto.
7.	Soot, and train oil,	$\frac{1}{4}$ oz.
8.	Soapers aſhes,	ditto.
9.	Wood aſhes,	ditto.
10.	Gunpowder,	ditto.
11.	Brimſtone,	ditto.
12.	Slaked lime,	ditto.
13.	Soot, and linſeed oil,	$\frac{1}{4}$ oz.
14.	Soapers aſhes,	ditto.

No.

15. Wood aſhes, - - - ¼ oz.

16. Gunpowder, - - - ditto.

17. Brimſtone, - - - ditto.

18. Slaked lime, - - - ditto.

19. Brimſtone and ſalt-petre, well incorporated.

20. Brimſtone, and ¼ oz. linſeed oil.

21. Ditto and ditto, train oil.

22. Brimſtone and Barton draining.

23. Linſeed oil.

24. Train oil.

25. Soot, - - ſowed over the bed.

26. Soapers aſhes, - ditto.

27. Wood aſhes, - - ditto.

28. Slaked lime, - ditto.

No.

29. Linſeed oil, and the covered drills ſcattered over with ſoot, when the plants began to appear on the ſurface of the ground.

30. Train oil, ditto.

The ſeed was ſteeped or mixed ſix hours in each ingredient, and the oil ſtrained through a fine ſieve.

On the 17th of July, 1786, I particularly examined all the beds; none had entirely eſcaped the fly. The leaſt injury was done to No. 30, 29, 24, and 23; which grew ſo luxuriant as to produce rough leaves ſeveral days prior to the moſt flouriſhing of any of the other numbers, by which they were better enabled to withſtand the fly's attack. The linſeed oil was the ſame as that uſed in the firſt experiment, its effect was inferior to that of train oil; which I do impute to the drying properties of the turpentine. The leaves of the ſeeds ſteeped in the oils alone, were of a much darker green, appeared twice as fat or thick, and the plants were a conſiderable degree larger than any of the others; and in point of luxuriancy they ſtand as under. Accordingly I preſume, that the ſmell of the ſoot muſt be diſagreeable to the fly, as No. 30 and 29 remained the longeſt without being attacked, although the injury they did to 30, 29, 24, and 23, were ſcarcely perceivable, and did not at all impede their growth.

No. 30, 29, 24, and 23, } Were far ſuperior to all the others.

No. 3, 5, 11, 17, 22, 25, 26, 27, 7, 13, and 19, } Were more luxuriant than any of the remaining numbers.

On the 8th, 19th, 31ſt of July, and 4th of Auguſt, I made ſeveral other experiments with turnip ſeed, barley, wheat, peas, and beans, ſteeped 6, 12 to 24 hours, and ſo long as ten days, the ſeeds were ſown broad caſt, and drilled. In every experiment with the turnip ſeed, I obſerved that what was ſteeped in the oil a leſs time than twenty-four hours, and immediately ſown with ſifted earth, vegetated much better than the ſeed that had been longer ſteeped. That ſteeped for ten days vegetated leſs than the ſeed ſown without any preparation. I found that oil, in every experiment, proved injurious to barley, wheat, peas, and beans; and that the grain ſown in its natural ſtate, vegetated beſt. Therefore as oil ſo peculiarly promoted the growth of turnips, and proved injurious to barley, wheat, peas, and beans; curioſity induced me, firſt, to examine through a microſcope, the ſtructure of turnip ſeed, which appeared ſpongy; from whence I conclude, that in conſequence of turnip-ſeed being generally ſown in the hotteſt and drieſt ſeaſon of the year, the heat and drying winds penetrate the pores, conſequently greatly injure the vegetative properties of the ſeed. Hence the plants grow ſickly, become ſimilar to blighted vegetables, and are thereby rendered an eaſy prey to the fly. Whereas oil enters and fills the pores, protects the germinating properties of the ſeed from the ſcorching heat and drying winds; thus by being preſerved, a little moiſture makes the ſeed vegetate with ſuch luxuriancy, as very ſpeedily to grow into rough leaf, when it generally becomes too powerful to be materially injured by the fly.

On a ſtrict examination of the grains of barley, wheat, peas, and beans, I found they were protected by an oily coat or ſkin, which, I preſume, defends their germinating properties from heat and ſcorching winds; and that the oil (in which the ſeed is ſoaked) tends to harden the grain, already ſufficiently protected by its natural covering. To what other cauſe can we attribute it? Future experiments, and a more able Inveſtigator, may better account for ſuch effects.

Oats are doubly guarded, by a thick oily ſhell, which when taken off, the inward grain appears to be again protected by an oily ſkin, covered with ſomething ſimilar to long hairs, extending from one end to the other, and forming a buſhy tail. I believe it is generally acknowledged, that oats are diuretic, and more heating than any other grain. May it not be owing to theſe ſmall hairy particles being indigeſtibly carried into the blood?

ON THE INCREASE OF GRAIN.

A Single cluſter of barley, growing in a field planted with peas, attracted my attention. The numerous ſtalks appeared to be the produce of ſeveral grains, but when pulled out of the ground, I clearly perceiv'd they were only the produce of a ſingle grain, which had been dropped by accident; curioſity induced me to count the number of ears, which were twenty-eight, containing in the whole three hundred and thirty grains. Such an amazing increaſe aſtoniſhed and made me reflect, if one grain produced upwards of three hundred, how came it that farmers could procure no more, and were well ſatisfied in obtaining a crop of from thirty to forty buſhels per acre, from four buſhels of ſeed, ſown in a loamy or ſtiff ſoil? The greateſt of ſuch product is only ten for one, and of courſe leſs by three hundred for one than the produce of the ſingle grain. Being fully convinced that the old mode of cultivation was very erroneous, I determined to endeavour to find out where the errors lay. I had a Wincheſter buſhel of barley meaſured, it weighed fifty-two pounds and a quarter, and according to the number of grains in one ounce, the whole buſhel contained five hundred and fifteen thouſand grains.

I next had a Wincheſter buſhel of wheat meaſured, it weighed ſixty-two pounds, and contained five hundred and ſixteen thouſand grains.*

A buſhel of poplar peas weighed ſixty-four pounds, contained one hundred and ſeven thouſand peas.

A buſhel of horſe beans weighed ſixty-four pounds, contained thirty-five thouſand beans.

A buſhel of oats weighed thirty-two pounds, contained one million two hundred and ſixty thouſand grains.

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* I have ſince weighed wheat and barley, which contained from three to ſeven thouſand grains more per buſhel than the above, which ought to be deemed the largeſt ſize.

EXPERIMENTS

ON

BARLEY.

HAVING thus far proceeded, I next reflected, that admitting every grain ſowed was to vegetate, and produce no more than even twenty for one, the produce of four buſhels of ſeed ought to be eighty buſhels per acre Therefore was fully determined as ſoon as poſſible, particularly to inveſtigate the future growth of grain. Opportunity did not permit my making any experiments till the following ſpring, when I had beds dug eight feet three inches long, and two feet wide, which occupies a ſpace of one ſixteenth part of a ſquare perch. I thought it neceſſary for my future conduct in Agriculture, to reduce the weight of the buſhel of barley, being fifty-two pounds and a quarter, into drachms, that I might the better be enabled to proportion to an acre, the quantity of ſeed moſt advantageous for drilling, and ſowing broad caſt; accordingly found that fifty-two pounds and a quarter, contained thirteen thouſand three hundred and ſeventy-ſix drachms. I then reduced an acre into ſixteenths of a perch, being two thouſand five hundred and ſixty; and dividing the drachms (thirteen thouſand three hundred and ſeventy-ſix, the contents of the buſhel,) by the number of ſixteenths, (being two thouſand five hundred and ſixty in an acre,) found the quotient to be $5,\frac{2560}{576}$ part of a drachm. Therefore, on the 17th of April, 1782, ſowed broadcaſt five drachms and a quarter, as being the neareſt proportion of one buſhel, Wincheſter meaſure, to an acre of land, on the firſt bed; and in proportion to two, three, and four, on the following beds.

The ſoil was a ſtiff unmanured loam, had been cropped with peas in 1781, was winter fallowed and dug a ſpit deep. The grain was dropped by hand in the drills two inches deep, as under.

No.		Weight.
1	ſowed broad caſt, - - -	5¼ drms.
2	ditto - - - - - - -	10½ ditto.
3	ditto - - - - - - -	15¾ ditto.
4	ditto - - - - - - -	21 ditto.

No.

No.		Weight.
	Four drills in each bed with ſix-inch intervals.	
5	two grains to an inch, -	19 drms.
6	one grain to an inch, -	9½ ditto.
7	one grain to 1½ inch, -	6¼ ditto.
8	one grain to two inches, -	4¾ ditto.
	Three drills in each bed with eight inch intervals.	
9	two grains to an inch, -	14 drms.
10	one grain to an inch, -	7 ditto.
11	one grain to 1½ inch, -	5 ditto.
12	one grain to two inches, -	3½ ditto.
	Two drills in each bed with twelve inch intervals.	
13	two grains to an inch, -	9 drms.
14	one grain to an inch, - -	4½ ditto.
15	one grain to 1½ inch, - -	3 ditto.
16	one grain to two inches, -	2¼ ditto.

No.

No.		Weight.
	Two drills on three feet beds, with intervals of fifteen inches.	
17	two grains to an inch,	9 drms.
18	one grain to an inch,	4½ ditto.
19	one grain to 1½ inch,	3 ditto.
20	one grain to two inches,	2¼ ditto.

Auguſt 23, 24, and 25,

Cut the ſeveral Beds.—Produce as follows:

No.

1 — 184 drachms, or 35 buſhels per acre.
2 — 207 ——— 39 ditto.
3 — 261 ——— 49 ditto.
4 — 289 ——— 55 ditto.
5 — 401 ——— 76 ditto.
6 — 443 ——— 84 ditto.
7 — 398 ——— 76 ditto.
8 — 391 ——— 74 ditto.
9 — 327 ——— 62 ditto.
10 — 378 ——— 72 ditto.
11 — 315 ——— 60 ditto.
12 — 310 ——— 59 ditto.
13 — 291 ——— 55 ditto.
14 — 300 ——— 56 ditto.
15 — 267 ——— 51 ditto.
16 — 250 ——— 47 ditto.
17 — 284 ——— 36 ditto.
18 — 289 ——— 37 ditto.
19 — 278 ——— 35 ditto.
20 — 269 ——— 34 ditto.

Thus the produce of No. 6, being in proportion to upwards of eighty-four buſhels per acre, is ſuperior to any other; which by this experiment proves, that the moſt advantageous diſtance between the rows is ſix inches, with the grains about an inch aſunder in the drills.

Every experiment was left without being hoed or weeded, that I might the better be enabled to obſerve the growth of weeds, the ſix-inch intervals contained few or none. When the corn was cut, the ground on which the ſix-inch drills grew, appeared more hollow, blacker, and moiſter, than the wider intervals; and according to the increaſe of diſtance between the drills, ſo in proportion was the increaſe of weeds, and dryneſs of the ſoil.

The roots of No. 6, in particular, and No. 9, were ſo matted or combined together, as to keep the ſoil more hollow, and had extended themſelves farther than any of the others; and I preſume, that the thickneſs of their ſhade at ſix inches diſtance, prevented the moiſture being exhaled, which cauſed a kind of conſtant fermentation in the ſoil. Hence, the ground appeared more hollow, moiſter, and blacker, than between the drills at greater diſtances.

In the year 1783, I made ſeveral experiments on a ſmall ſcale, by drilling and ſowing grain alone, and immediately mixed with wood, coal, ſoaper's aſhes, ſlaked and unſlaked lime, ſoot, and rotten dung; and in all my experiments, which are too trifling and numerous for inſertion, it is ſufficient to obſerve, that the above mixtures produced leſs crops in proportion to the corroſive properties of the manures; and that the dung made the ſtraw grow ſo luxuriant, as to produce ſmall heads, as alſo more liable to be beat down by heavy ſtorms of rain; and every ſpecies of grain and pulſe ſowed alone, produced in every inſtance, a greater increaſe, than when mixed immediately with the manures, which I am thoroughly convinced ſhould be well incorporated with the ſoil, ſome little time before the grain or pulſe is ſown.

Farmers in general prefer ſmall to large grain for ſeed, being of the opinion that ſmall grain better ſtocks the land, and produces the moſt plentiful crop. I have planted ſingle grains of different ſpecies and ſizes, and have always found that the larger and plumper the grain, the greater was the produce; and moſt of the large grains vegetated, while twice the number of the ſmaller failed.

On the 9th day of June, 1786, I again made forty-three different experiments on early barley, by ſowing broad caſt, and drilling at various diſtances, with different quantities of ſeed, on beds eight feet long and two feet wide; the ſoil a ſtrong loamy clay, manured only with the aſhes of the couch graſs, which it contained. This trial, tho' ſo late, was further made with a view of being better able to aſcertain the moſt advantageous quantity of grain to be ſowed, and diſtance between the rows.

The ſeaſon being warm, dry, and ſo far advanced, I had all the beds watered, and having no rain for ſome time after, the barley vegetated very irregularly, altho' every care was taken to water it with garden-pots, as equally as poſſible. The barley ripened very late, the ears were of a middling length, but the grains were very ſmall, and one half the crop eaten by the birds, tho' every effort was uſed to keep them off. Thus I was diſappointed in attaining a knowledge of the crop; but from the quantity of ſtraw, and the appearance of the grain, this experiment correſponded with the other. Therefore I am ſo far convinced, that barley and wheat drilled, at about ſix inches diſtance between the rows, produce the greateſt crops, and the land is left in the beſt and cleaneſt condition.

Experience inſtructs me, that the quantity of ſeed ſown ſhould be governed by the poverty or richneſs of the ſoil. The poorer the land is, the greater quantity of ſeed ſhould be ſowed; becauſe the poverty of the ſoil does not afford ſufficient nouriſhment to ſtrengthen and enable the roots and tender fibres to extend themſelves, conſequently the plants tiller leſs. Hence on the contrary, the richer and better condition the ſoil is in, the leſs quantity of ſeed is required; becauſe the roots and tender fibres acquire ſuch nouriſhment, whereby they are ſtrengthened and enabled to extend themſelves, in proportion

portion to the richneſs of the ſoil; and of courſe the plants tiller the more, the ſtalks are alſo ſtronger, produce greater crops, and as having more extended roots, which anſwer the purpoſe of a ſheet anchor, are better able to withſtand the heavy ſtorms of winds and rains. But when the ſeed is ſown too thick, particularly broad caſt, the crop is deprived of the free current of air, the plants grow tall and weak, are ſoon laid by ſtorms of wind and rains, and the produce is generally ſcanty. Hence the quantity of ſeed ſown ſhould be wholly regulated, in proportion to the richneſs or poverty of the ſoil.

In all my experiments on wheat and barley, drilled at the ſame equal depth, and where the grains were planted two inches apart in the rows, I could viſibly diſcover that many grains, even of the largeſt ſize, never vegetated; which induced me to make ſeveral experiments with ſteeps; to recapitulate the whole, might tend to bewilder the imagination. Therefore, I will only obſerve, that I have found the following to be the moſt fertilizing, and effectual to prevent blights or ſmut: viz.

Take one peck and a half of wood aſhes, and one peck of unſlaked lime, which put into a tub that will contain about forty gallons of water, then add as much water as will ſlake the lime, and render the mixture (which ſhould be well incorporated) into the conſiſtence of ſtiff mortar, in this ſtate it ſhould remain ten or twelve hours; afterwards add as much water as will reduce the mortar to a pulp, by ſtirring; then fill the tub with water, which muſt be ſtirred for two or three days; then draw off the clear lye into a proper veſſel, and gradually put the grain into it, ſkimming off the light corn; after the corn has ſteeped three hours, let it be taken out, and immediately ſpread on a clean floor to dry, when it will be ſufficiently prepared for drilling or ſowing. The lye will retain its full virtue, and the ſame may be repeatedly uſed.

As all the grains appeared plump and healthy when planted, I preſume that thoſe which did not vegetate, muſt have been bruiſed in threſhing, or trod upon when winnowed; to prevent the latter, I oblige my threſhers to winnow ſeed wheat with their ſhoes off. But further inveſtigations may be eaſily made to aſcertain this point.

On examining the grains of wheat and barley through a microſcope, I have frequently obſerved ſmall quantities of black powder on the flat or hollow part, or on the downy end of the grain, but too minute to diſcover by my glaſs, that they were animalcules.

As I deem the practice of common brining to be only uſeful for deſtroying ſmall inſects, (inviſible to the naked eye) which grain frequently harbours; in order to diſcover what effect the ſteep lye would have on inſects, I procured ſeveral common red worms; I carefully choſe two, alike in ſize and ſtrength, one was put into a glaſs of ſpring water, the other into a glaſs of the lye; the laſt immediately appeared to be in great agonies, and died within forty minutes. The worm that was put into the ſpring water, was alive and active at the expiration of three weeks, when it was thrown into the ſtreet.

From this experiment I conclude, that as the lye operated ſo violently on an amphibious inſect, animalcules, that are not amphibious, muſt naturally be deſtroyed in a much ſhorter time. And in every experiment, I have found that lye, when it has not been too ſtrong, has promoted the growth of corn and pulſe; when, on the contrary, oil has proved injurious.

IMPERFECTIONS

OF THE

OLD MODE OF CULTIVATION

POINTED OUT.

MY next attention was to the ſowing of wheat, two buſhels of ſeed per acre, on a clover lay; the ſoil a loam, about ſeven or eight inches deep, on a ſtone braſh clay. The ground was perfectly dry the firſt day of ſowing, the ſeed appeared to be well covered by frequent harrowings. Very heavy ſtorms of rain fell the ſucceeding night, the next morning I obſerved the birds and rooks very buſy on the part that had been ſown, which on examining, I found the heavy ſtorms that had fallen in the night had waſhed off the mould, and expoſed great quantities of the wheat on the ſurface, which the birds and rooks were feeding on: This partly accounted for a deficiency of produce. On this ſame day my ſervants ſowed the remainder of the field; the land was ſo thoroughly moiſtened with the rain that had fallen in the night, that it was obliged to be harrowed more than the other to cover the ſeed, by which I obſerved the horſes feet ſunk deep in the earth; and on a future inveſtigation found, that great part of the ſeed had been buried by the treading of the horſes, and never vegetated, but was rotted by the water being retained in the tracks of the horſes feet. Several other ſimilar remarks, confirmed the impropriety of ſuch conduct on loams and ſtiff ſoils. One further inſtance in particular, will, I truſt, ſuffice, leaving the induſtrious Agriculturiſt to improve from the advanced hints. I accidentally paſſed through a neighbouring farmer's field, where he was ſowing barley, the ſoil a good rich ſtiff marly loam; four heavy oxen drew one pair of harrows ſeveral times over the ſame ſpot, with an intent that the ſeed might be effectually covered, and the land made fine. In a few days after, the field was rolled with a heavy roller, drawn by the ſame heavy oxen; I obſerved that the land was greatly hardened, and that the oxen's feet had made a moſt viſible impreſſion in the ground, which could not be levelled by the roller.

I particularly attended to the vegetation of the grain, and obſerved that on thoſe ſpots where the oxen had trod, the ſeed did not germinate; and when the barley ripened the ſtraw was ſhort, few ears contained more than twenty grains. In ſhort there was not half a crop.

NEW
MODE OF CULTIVATION
POINTED OUT.

THOSE circumſtances diſcovered to me, in repeated inſtances, the imperfections of the old or common method of cultivation. Hence, knowing the cauſe, reaſon ſuggeſted that it ſhould be neceſſary to endeavour to find out a remedy; or rather that the old mode ſhould be diſcontinued, and if poſſible, ſome new or better method of culture ſhould be adopted.

ed. By obſervations and cloſe attention, I ſoon ſucceeded. I fixed together with a poll, three harrows, which when meaſured, I found would compleatly cover the breadth of eight feet.

I accordingly had my fields formed into eight feet ridges, the three harrows compleatly covered theſe ridges; and inſtead of the horſes treading the pulverized land, four horſes were parted, two walked in the furrows each ſide of the ridge, by which the ſoil was properly harrowed without being trod or hardened, and the ground made ſufficiently fine.

The repeated trials I have made of this *New Mode of Culture*, has ſufficiently confirmed me of its utility. One recent experiment will, I preſume, as well as one hundred, illuſtrate its ſuperior advantages. The field, No. 4, that had produced (as per p. 143) two ſucceſſive crops of potatoes,

toes, the laſt of which could not be got out of the ground till the latter end of November; particular buſineſs intervening, prevented the land being got into proper order before the 16th of December, 1785; as the field meaſured but four acres, and was in excellent tilth, curioſity induced me to ſow it, even ſo late in the ſeaſon, with cone wheat; for which purpoſe my drill machine was uſed upon a few buts or ſhort ridges, which were planted with a proportion of one buſhel to an acre, the rows at one foot apart, on ridges eight feet broad; but ſuch an exceſſive heavy fall of rain commenced, as ſoon reduced the ſoil to a mere quagmire, the horſes ſunk to their knees in the ridges. Hence the drill could not be worked.

Thus, part of the field being drilled, and no proſpect of more favourable weather at ſo late a period of the ſeaſon; my ſervants, and myſelf (attending the operation of the machine,)

machine,) were thoroughly wetted; the weather being rather warm, my people continued in the field, ſowed the remainder with two buſhels and a half per acre, and even in ſuch a wet ſtate harrowed in the ſeed, with three harrows covering the ridges, two horſes walking in each furrow. And that I might be further convinced of the diſadvantages attending the horſes treading on the ground, I permitted two ridges to be harrowed by the horſes walking thereon. In the month of January the rooks did me much injury, which I obſerve, they always do on late ſown wheat; for when the ground is frozen and covered with ſnow, they cannot get at worms and inſects on paſtures; in this caſe, theſe ſagacious birds, inſtigated by hunger, ſcratch off the ſnow, whereby they diſcover the blades of the corn, and with their beaks ſoon get at the milky grain, which they feed on. But at particular periods, ſuch as when plowing of land, and in wet weather, when worms appear on the ſurface of paſtures, rooks follow the plow, pick up the grubs and worms off arable and paſture lands, ſo far they are ſerviceable: but in dry weather, when the ground is hard, and no worms can appear, birds, more than animals, will not ſtarve, but riſque their lives in purſuit of that food which ſupports them.

In ſhort, rooks are of ſervice to paſtures, but very injurious to the tillage farmer. And from repeated experiments, I know of but one method ſufficiently effectual to deſtroy them.

In the month of May I had the drilled wheat hoed, for which I paid after the rate of eighteen-pence per acre. The other part of the field was weeded, at an expence of about two ſhillings and ſix-pence per acre; and during the whole time of its growing, the drilled wheat viſibly appeared ſuperior, in every reſpect, to the broad caſt; the ſtraw was in ſize ſimilar to reeds, many meaſured upwards of ſix feet in length, and the ears contained from ninety to one hundred and twenty grains.

On the 12th day of September laſt, I had three perches each of the drilled, the broad caſt by the new mode of culture, and the broad caſt ſown in the common way, carefully cut, carried into the granary and there threſhed:

The Produce as under, viz.

Drilled.—Four pecks and half a pint; or, per acre, fifty-three buſhels and three pecks.

Broad caſt, new mode.—Three pecks and ten pints; or, per acre, forty-eight buſhels, one peck, and five pints.

Broad caſt, old mode.—Two pecks and ſix pints; or, per acre, thirty-one buſhels, two pecks, and ten pints.

The whole, Wincheſter meaſure.

The drilled, and broad caſt by the new mode of culture, were cut from off ridges adjoining each other, which were at the diſtance of about five perches from the hedge. The three perches of the old mode of culture were alſo near another hedge, all the ground they grew on of equal quality, and neither of theſe ridges injured by the rooks, who generally dropped near the middle of the field; the crop thereof was threſhed and winnowed in December, 1786, the whole produce of the four acres amounted to one hundred and fifty-three buſhels, being thirty-eight buſhels and one peck of nine gallon meaſure, or ſomething more than forty-three buſhels of Wincheſter meaſure per acre. Hence, by computation from the three perches cut off the new mode of broad caſt, the rooks muſt have eaten as much ſeed as in all probability would have produced about five buſhels per acre more.

This comparative view clearly illuſtrates the diſadvantages attending the horſes walking on the grain, after it is ſowed; which old mode produced near ſeventeen buſhels per acre leſs, than by the new method of the horſes walking in the furrows; and although the drill worked to every diſadvantage, in what might be partly called mortar, with depoſiting only in proportion to about one buſhel of ſeed, eight gallon meaſure per acre, and at twelve inches diſtance between the rows; yet it produced five buſhels one peck and eleven pints, more than the new broad caſt mode, ſown with two buſhels and a half of nine gallon meaſure, of ſeed to an acre. And I am now confident, that if I could have drilled my wheat in rows at ſix inches, my crops would have been at leaſt half as much more productive than they were.

EXPERIMENTS

ON

WHEAT.

ON the 29th of November, 1785, I drilled a ſmall field of two acres and a half (that had been cropped with hoed beans, which were carried off the land the latter end of October,) with two buſhels and a half of cone wheat, two inches deep, at the diſtance of twelve inches between the rows. The ſoil a loam on a ſtone braſh clay.

In the month of February, 1786, a dairy man's ſix heavy bull ſtags and dry cows, which were kept in ſuch a manner as to be half ſtarved, broke over a well ſecured fence into my field of wheat, which they eat and greatly damaged by trampling over every part. The impreſſion of their feet was ſo great, that wherever they trod, the ſoil was ſo compreſſed, as to retain the water in the tracks, and the plants were entirely deſtroyed thereby.

In the month of March, the field was hoed. In the month of September, twenty-eight of the ſame dairy man's turkies, which were permitted to live on the public, diſcovered their great ſenſibility by maurading in my field of wheat, where they moſt freely and plenteouſly regaled themſelves. The field was ſurrounded with hedges, containing luxuriant trees and thorns, that harboured immenſe numbers of ſmall birds, which (as is always the caſe, in ſuch ſmall paddocks near a houſe,) eat an amazing quantity of the wheat whilſt ripening, and particularly off ſuch ridges as adjoined the hedges.

Nevertheleſs, under all theſe diſagreeable circumſtances, the crop was threſhed out laſt month, and the whole produce was eighty-four buſhels and a half, which is about thirty-four buſhels of nine gallon meaſure, and equal to thirty-eight buſhels and a half of Wincheſter meaſure per acre. A pint weighed fifteen ounces and nine drachms, which multiplied by ſixty-four, the contents of a buſhel Wincheſter meaſure, its weight was ſixty-two pounds and four ounces, per Wincheſter buſhel.

Had not the cattle, turkies, and birds done ſo much injury, I have not the leaſt doubt, but that the produce of this field would have been near ſixty, inſtead of thirty-eight and half, Wincheſter buſhels per acre.

The advantages reſulting from hoeing, induced me in autumn 1785, to drill my wheat at twelve inches diſtance between the rows; ſince that time, I have had hoes made of proper ſizes to work between the nine and ſix inch intervals.

In the year 1785, the field No. 3, was drilled with beans after wheat. (See p. 149 and 130.) At ſo late a ſeaſon as the 17th day of May, 1786, I drilled this field, which is the pooreſt land on my farm, with a buſhel and a peck, Wincheſter meaſure, of Siberian or ſpring wheat per acre, full two inches deep, and at nine inches between the rows. It was hoed only once, was reaped the 23d of September, when I had three perches carefully cut, carried into the granary, and there threſhed; the produce was two pecks and four pints, which is in proportion to thirty Wincheſter buſhels per acre. About the middle of September we had ſome very heavy ſtorms of wind and rain, that beat great quantities of the wheat, which was then ripe, out of the ears; the grain appeared as if it had been ſowed broad caſt, and by the opinions of ſeven men, whom I then had reaping, there could not be leſs than near three buſhels per acre ſcattered over the ground; however, I will call it two and a half buſhels, which, with the proportion of thirty buſhels threſhed, makes in the whole, thirty-two and one half buſhels per acre. No part of the corn was laid by all that tempeſtuous weather, ſo as to do it the leaſt injury. Such are the ſuperior advantages of drilling to broad caſt; particularly, the nearer the rows are to each other, the better they are ſupported.

One caution I will beg leave to notice, that the grain of ſpring, or Siberian wheat, is much more liable to drop out of the ears, than the grain of any other ſort of corn. Hence, it ſhould be particularly attended to, and cut before it is ripe.

Laſt autumn I drilled wheat at ſix, nine, and eleven inches diſtance between the rows: From the preſent appearance, that at ſix inches is ſuperior to all the others; and if no particular accident happens, I have not a doubt of the ſix-inch intervals producing about ſeventy Wincheſter buſhels per acre.

On the 18th of April, 1786, two ridges, meaſuring thirty-ſix perches, were drilled with carrot ſeed, at about one and a half to two inches deep, and one foot diſtance between the rows; they were once hoed with a running hoe, and as I only intended to try how my machine would deliver the ſeed, the plants were neither thinned nor weeded. This experiment was made on a very improper ſoil, being a ſtiff loam. They were plowed up the 2d of November, the roots were very thick in the drills, but ſmall in ſize, few meaſured more than about twelve inches in length; after the leaves were cut off, the produce was eighty-nine buſhels.

As I then intended preſenting the Bath Agriculture Society with an account of my produce, and the utility of my machine; I had a ſurvey of my crops taken by the clergyman and church-wardens of the pariſh in which I reſide.

The following is a Copy:

"WE, whoſe names are hereunto ſubſcribed, the Miniſter and Church Wardens of the pariſh of Henbury, in the county of Gloceſter, do hereby certify, that we have this day ſurveyed and particularly examined about eleven and one half acres of land, which was drilled with wheat, in equi-diſtant rows of twelve inches aſunder; which was hoed, and appeared perfectly clean from weeds.

" We likewiſe certify, that the crops on the above land appeared to us to be very flouriſhing, luxuriant, and far ſuperior to any crops of wheat in this part of the country.

" We alſo certify, that we have examined two ridges, which were drilled in equi-diſtant rows of twelve inches, with carrots, that appeared very regular and flouriſhing; all which belonged to MR. WINTER, of *Charlton*, in the above pariſh, and were drilled by his machine, which we have examined, and it appears to us to be conſtructed on the ſtrongeſt and moſt ſimple principles. We alſo certify, that we have examined his crop of barley, drilled in equi-diſtant rows of nine inches, and that it is excellent.

" In Witneſs whereof, We hereunto ſubſcribe our names. Dated at *Charlton* aforeſaid, this fifth day of June, 1786.

(Signed)

Henry Donne,	Clerk.
Wm. Ogborne,	Church-wardens.
Joseph Wheeler,	
Thomas Cooke,	Inhabitant."

Having obſerved the imperfections of the old mode of culture, and endeavoured to point out a remedy; I muſt now revert to my experiments on barley, (p. 260) which correſponding with the different quotations from ſuch reſpectable authors, left no doubt remaining, relative to the ſuperior advantages reſulting from the drill, to the common broad caſt mode of huſbandry; and as I could

I could not procure ſuch a machine as ſuited my inclination, in the month of January, 1783, I conſtructed one, which in theory appeared likely to anſwer my expectations; but when put into practice, was extremely incompleat. I then altered my plan, and taking the hint from a mill, I again employed a carpenter at my leiſure time, and in about twelve months after, made one to drill at twelve inches, which at firſt I deemed compleat, and accordingly ſet it to work, but was again diſappointed. However, by great perſeverance, and the moſt ſtrict attention, for whole days, to its working in the field, I was thereby enabled, from time to time, to diſcover and rectify its imperfections.

As I obſerved the diſtance of about ſix inches to be the moſt advantageous between the rows, I faſtened the ſix coulters on the coulter bar, but found that the ſpace between the coulters was only about four inches; conſequently ſtones, clods, and weeds ſoon choked them. Being thus chagrined at my diſappointment, and much fatigued, I ſeated myſelf on a ſack containing the ſeed, on the head land: A pair of harrows were placed upright againſt the adjoining hedge; I obſerved ſome of the tines were loſt or miſſing, which on examination, I accidentally notic'd the triangular working poſition of the tines; I was ſo ſtruck with the idea, that I loſt not a moment's time in ſending for my carpenter, and had an additional coulter bar immediately made; three coulters remained on the old bar, the other three were fixed on the new bar, and in the center of the coulters on the old bar; which then formed an angle, and ſpace of twelve inches between all the coulters. By being thus ſet, none of the coulters were clogged; large ſtones, clods, and weeds paſſed between, and the machine worked with pleaſure in the rougheſt and moſt ſtony land, where the ſtones did not exceed ſeven or eight inches in diameter.

Thus, after being at a great expence, upwards of three years ſtudy and cloſe attention to its executive powers in the field, I at laſt ſucceeded beyond my moſt ſanguine expectations, in the invention of a moſt ſtrong and ſimple machine; and ſuch, as any perſon at the firſt view, would naturally ſuppoſe, might be invented in three months, inſtead of three years. But, were the ſeveral alterations which I made during that period to be minuted, I am fully convinced they would be ſufficient to fill a large volume.

B L

Winter's Patent Drill-Machine.

Fig. 1

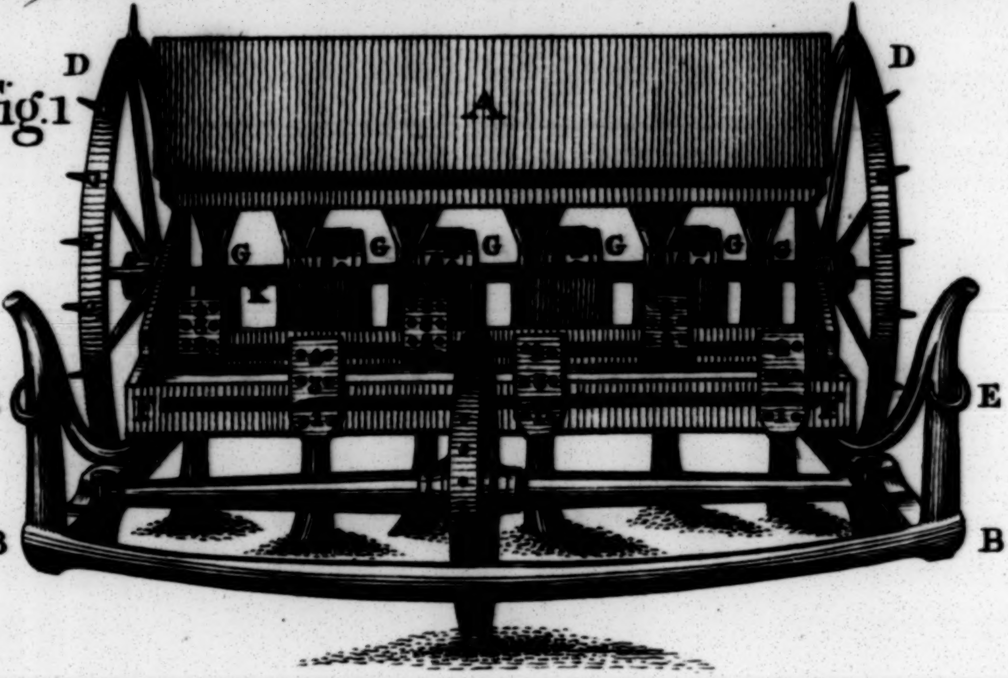


Fig. 2

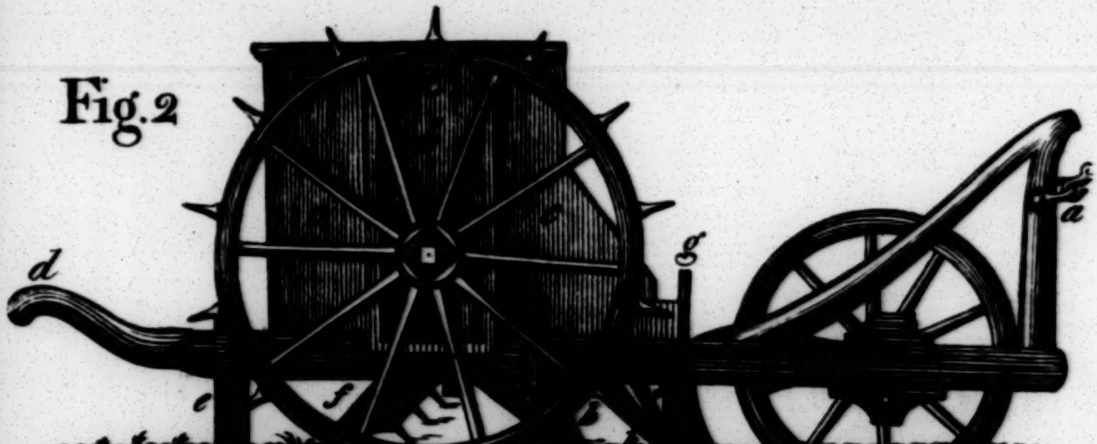
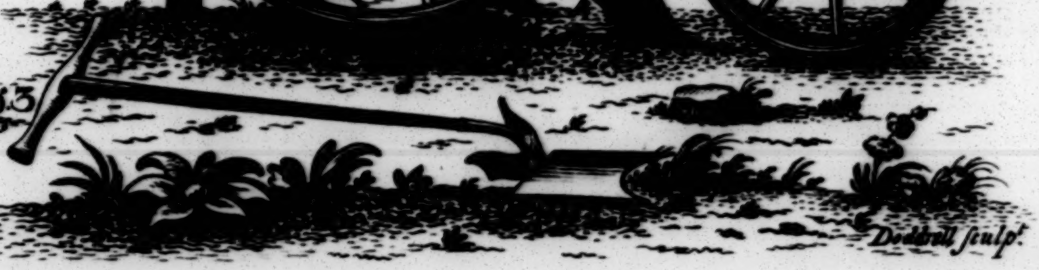


Fig. 3



Doddrell sculp.

THE

DESCRIPTION AND USE

OF A

PATENT DRILL MACHINE,

INVENTED BY

THE AUTHOR.

References to the annexed PLATE.

FIG. I.

REPRESENTS a front view of the machine when at work, with ſix coulters faſtened on.

A The fore flap is turned up, and the back board taken off, for the purpoſe only of repreſenting the inſide work, which when drilling in the field is all encloſed; it then appears as a cheſt or box between two wheels, and all the inſide work is perfectly ſecured from the effects of the moſt tempeſtuous weather.

B The Frame.

C Iron plates, in which the gudgeons of the fore wheel are placed In this poſition, by having the wheel fixed in the upper hole, all the three wheels are on a level with each other. But when the fore wheel is to be ſet for the purpoſe of travelling, it is inſtantaneouſly removed into the loweſt holes of the plates, by which the coulters will be elevated about five inches above the ſurface of the ground, and by means of temporary iron wheels, (which are occaſionally fixed into the back part of the frame, for removing it from one field to the other,) the large wheels with the ſpikes, are alſo elevated ſo high, as to be on a level with the coulters.

D D The two hind wheels, with ſpikes, which are for the purpoſe of preventing the wheels from ſliding over rough ground or clods; and by the ſpikes penetrating into the earth, the wheels are forced round, by which the grain is delivered; for when the wheels ſtop, no grain is diſcharged.

E E Iron rings, faſtened to the fore ſtandards, to which the traces or chains are fixed for drawing the machine.

F F Two coulter bars, each alike, containing grooves cut horizontally for the reception of bolts and ſcrews, by which the coulters are faſtened; and to prevent the wood work being injured by the ſcrews, plates of iron are affixed under the nuts:—

Bolts and nuts are alſo paſſed through the coulter bars perpendicularly, to prevent the grooves from opening; and through theſe grooves (which extend the neceſſary length of the coulter bars) the coulters may be placed at any required diſtance, from ſix, ſeven, eight, nine, ten, to thirty-ſix inches, or more.

1 2 3 4 Six coulters, numbered between the bolt holes; which figures are a government for ſetting the coulters to the required depth for depoſiting the grain. For inſtance, when the bolts are paſſed through the loweſt holes without any numbers, the coulters are on a level with the three wheels; when the bolts are fixed over figure 1, the grain is depoſited at one inch; when over 2, at two inches; over 3, at three inches; and over 4, at four inches under the ſurface of the ground. And accordingly may be made ſo as to depoſit at any greater depth.

G Six cylinders, which occaſionally ſlide off and on the axis, ſo as the whole, or any number of them, may be fixed at any required diſtance.

The four large cylinders contain two ſets of cavities or holes, and grooves, into which the ſeed boxes are fitted. The ſmall cavities are for the delivery of wheat, barley, St. Foin, or other large ſeed, and by every revolution of the large wheels, (which are 114 inches in circumference,) about 114 grains of corn are regularly dropped on the ſame length of land; but the ſeed may be increaſed to any required quantity, by means of the ſliding regulators, which are inſtantaneouſly raiſed or lowered, and fixed by nuts and ſcrews to the inſide of the ſeed boxes.

The double rows of large cavities are for the purpoſe of drilling horſe beans at three inches, or peas at one inch apart in the rows;

rows; alſo oats, carrots, turnips, or any ſmall ſeed. When theſe cavities are to be uſed, the wheat boxes muſt be taken off, and another ſet of boxes, adapted to the cavities of the cylinders, are faſtened on, ſo as to drill at any required diſtance; and to the inſide of theſe boxes are alſo fixed ſliding regulators, which, by being elevated or depreſſed, increaſe or decreaſe the quantity to be ſown. Three inches I deem to be the beſt depth for drilling peas and beans.

H Seed boxes which are faſtened with three ſcrews in the frame.

I Conductors, into which the ſeed is delivered out of the cylinders, and conveyed into the grooves or hollows in the back parts of the coulters, and to ſuch required depth in the ground as the coulters may be ſet at. Theſe conductors are removeable, they are faſtened with ſcrews to a bar at the back part of the machine, and ſupported by bars which extend under them acroſs the frame.

K The axis which paſſes through the cylinders and large wheels, is ſupported by braſs collars, (that cannot be diſcover'd by this view) which have holes through the upper ſurface, to drop oil into, and are covered with buttons or ſliders to prevent dirt or duſt falling into the holes.

A harrow is fixed to the back part of the machine, which, with a marker and travelling wheels, cannot be ſeen in this view.

Fig. II.

REPRESENTS a ſide view of the machine when at work.

a Iron ring, with a hook and chain fixed to it.

b A ſliding board, that covers an opening in the caſe or box, through which the axis and cylinders are taken out.

c The caſe or box that contains the inſide work, which will equally execute in the moſt windy, as well as in calm weather.

d The handles, which are for the purpoſe only of lifting up the machine at the head lands, and placing it in its proper direction.—When all the boxes are filled with ſeed, the weight of the machine is not as heavy to lift up, as the weight of a common ſize loaded wheelbarrow.

e The marker, which is faſtened with a bolt and ſcrew into that part of the frame which contained one of the travelling wheels.—

wheels.—The uſe of the marker is to make a furrow in fields which are not ridged, ſuch furrow being a guide for the plowman's working the machine, when the impreſſion of the wheels is not ſufficiently diſcoverable.

f The harrow, for the purpoſe of more effectually covering the ſeed and making the land even.

g One of the three coulters on the fore coulter bar.

h One of the three coulters on the hind coulter bar.

i The guard, which enters into the groove of the coulter, and protects the pipe of the conductor from being injured by ſtones, or clogged with dirt or weeds.

k The pipe of the conductor, which enters into the cavity in the back part of the coulter.

The machine has two frictions only, viz. one on the gudgeons of the fore wheel, (which any ſmith can repair or replace) and the other on the axis of the hind wheel, which is ſupported by ſtrong braſs collars. The coulters are of ſuch a height and diſtance from each other, as to be capable of working in couchy, ſtoney, and every kind of ſoil, except rocky ground. And whatever accident may careleſsly happen to the caſe or wood work, ſuch may be eaſily repaired by any carpenter. All the principal working machinery is ſo ſtrong, that nothing but wilful and the greateſt violence can poſſibly injure it. —With care it will laſt thirty years or more.

The machine can be made to any dimenſions, for the garden as well as the field. And the cylinders may be made of either braſs, iron, or wood.

A man, boy, and two horſes can drill with this machine, eight acres of ſtiff, or ten acres of light land in one day; at the ſame time effectually cover the ſeed.

FIG. III.*

REPRESENTS a running hoe for cutting the weeds between the drills, and adding earth to the rows of vegetables. The two points collect the weeds which are in a manner encloſed, and more effectually deſtroyed than when the blade is ſquare or angular.

Hoes may be eaſily made on the ſame plan of any ſize, by country ſmiths. The breadth of about three, or three inches and a half, are beſt adapted for ſix-inch intervals,

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[*] Is not the invention of, but altered by the Author.

vals, and in proportion for rows at greater diſtances.

The moſt proper ſeaſon for hoeing is, before the ears of corn are formed in the ſtalks, or when the plants cannot be injured by treading, and when the earth is ſufficiently dry, ſo as to quit the hoe: Such an opportunity ſhould by no means be neglected; when as many careful hands as can be procured, ſhould be ſet to work. I have particularly obſerved, that by hoeing between rows at twelve inches diſtance, the plants are greatly trod on, which do them no injury when young; but when the ſtalks grow large, the weight of a man bruiſes the ſtems, which frequently periſh. In light ſoils a man can hoe two acres a day between intervals of twelve inches; and in proportion between nearer rows, and on ſtiffer ſoils. Particular care ſhould be taken that the hoers do not cut the young plants.

I muſt beg leave to refer the reader to p. 253, for the number of grains of corn, &c. contained in a Wincheſter buſhel. As every ſpecies vary in ſize, I have ſince endeavoured, with the greateſt exactneſs, to aſcertain, and I do believe that the medium may be deemed nearly as under, viz.

Cone wheat. A Wincheſter buſhel contains five hundred and fifty thouſand grains.

Barley. Five hundred and twenty thouſand grains.

Poplar peas. One hundred and ten thouſand.

Horſe beans. Thirty-ſeven thouſand.

I have already obſerved, that the moſt proper diſtance for depoſiting wheat, barley,

ley, and peas, is about one inch apart in the rows, in a good ſoil; we will now calculate the number of inches contained in drills at a foot diſtance on an acre of land, which will diſcover the quantity of grain that ſhould be uſed in good ground.

A perch, being ſixteen feet and a half long, contains one hundred and ninety-eight inches, which multiplied by ſixteen rows or drills, at a foot diſtance for the breadth of ſixteen feet and a half, is three thouſand one hundred and ſixty-eight, which being multiplied by one hundred and ſixty, (being the number of ſquare perches in an acre,) diſcovers to us, that drills one foot aſunder on a ſtatute acre, meaſures five hundred and ſix thouſand eight hundred and eighty inches in length, of courſe takes that number of grains of wheat for ſeed, which is three pecks and nearly three pints. When drilled at nine inches diſtance, takes about half a pint leſs than a buſhel. When at ſix inches diſtance, takes one buſhel and three quarters of a peck Wincheſter meaſure, or one buſhel and four pints of nine gallon meaſure. But I muſt again obſerve, that the quantity of ſeed ſown ſhould be regulated by the richneſs or poverty of the ſoil.

In order to cleanſe the wheat from ſmut, and kill any animalcule that may harbor in the grain, uſe the ſteep as directed in page 266; particular care muſt be taken to keep the grain free from ſtones, dirt, and lime, which in every experiment I have made, I always obſerved it to be hurtful to vegetation when applied immediately with the ſeed, which is injured by its corroſive properties deſtroying part of the oily and vegetative powers of the ſeed or grain.

Barley ſhould likewiſe be ſteeped the ſame as wheat, after being well ſhook in a ſack by two men, (ſtumping will bruiſe it) to be cleared from ailes. Peas are generally greatly injured by worms and animalcule, they alſo ſhould be ſteeped. I muſt particularly obſerve, that all ſorts of ſeeds and grain ſhould when drilled be dry, and free from dirt or ſtones, which may injure the cylinders, or prevent a regular delivery.

When four feet ridges (which are about the breadth of the machine) are intended to be drilled, they muſt be well harrowed by the horſes walking in the furrows, which will draw the earth therein, and thereby prevent the ridges being poached by treading. In this caſe, a croſs-tree bar muſt be fixed to the fore ſtandards, which have holes to paſs bolts through, for the purpoſe of occaſionally faſtening on ſuch bar. The coulters muſt be faſtened by the loweſt holes, and the fore wheel placed in the third hole from the top, which will raiſe the coulters above the level of the hind wheels, which working in the furrows, will depoſit the grain ſufficiently deep in the ground; and after drilling, plow the furrows about ſix inches deep, with a double mould board or common plow.

When eight feet ridges are planted, the coulters muſt be placed at No. 2; two horſes are put to go before each other, the hinder one to be led ſtraight by the man walking up one furrow and returning the other. The eight feet ridges ſhould be harrowed with three harrows faſtened together, the horſes walking in the furrows each ſide of the ridges to prevent the ground being trod. When the machine is uſed on lands not ridged, ſhould the impreſſion of the wheels be inſufficient to direct the driver, the marker muſt be faſtened in one of the grooves which receives the travelling wheels, and with the ſame bolt and nut. The marker will make a ſufficient furrow to obſerve the laſt ſowed ground.

When the coulters are to be placed at any further diſtance than ſix inches, take off the ſeed boxes, unſcrue the two wheels, draw up the ſliding board, take out the pins or keys which faſten the iron work of the braſs collars, when they can be eaſily removed by puſhing them out of the grooves, then carefully take out the axis with the cylinders, and ſlide off as many as are neceſſary.

The cavities in the large cylinders and broad ſeed boxes are for beans, peas, oats, carrot, and other ſmall ſeeds; when drilled at a foot, four coulters are to be faſtened to the hind coulter bar; when at any greater diſtance, a proportionable number is to be placed on the bar, then fix the conductors to the coulters, and ſlide on the ſame number of cylinders, which place over the center of the conductors, and ſcrew on them their reſpective ſeed boxes, that are of the ſame mark or number as the cylinders they belong to.

When clover is intended to be ſowed with barley, as ſoon as the barley appears above the ſurface of the ground, ſow the clover ſeed, which buſh in, by the horſes walking in the furrows.

DIRECTIONS

FOR DRILLING

CARROT SEED.

CARROT ſeeds are very light and ſticky. After making numerous experiments, I found the following method to be the beſt for an acre of land, or in proportion, when drilled at one foot diſtance between the rows, viz.

Take two buſhels of dry loamy earth, finely ſifted, to which add one buſhel of bran, and a ſufficient quantity of carrot ſeed cleaned from ſtalks and well rubbed between the hands, all which thoroughly mix together and drill.

The carrot ſeed will ſtick to the bran, which with the earth will be regularly diſcharged through the large cavities in the cylinders.

DIRECTIONS

FOR DRILLING

TURNIP SEED.

STEEP turnip ſeed twelve hours in train oil, which ſtrain through a fine ſieve, and immediately thoroughly mix the quantity of ſeed you would wiſh to ſow to an acre, with three buſhels of dry loamy earth, finely ſifted; which drill about two inches deep, as ſoon as poſſible after the ſeed has been ſteeped. When the plants begin to appear upon the ſurface,

face, ſow a ſmall quantity of ſoot, or the alkaline manure as per page 63, over them. And for further information, ſee Experiments on Turnips, page 246.

N. B. A ſmall quantity of oil will be ſufficient for a large quantity of ſeed, as it may be repeatedly uſed till the whole is conſumed.

Lucerne, or any other ſmall ſeed, may be mixed with three buſhels of dry ſifted earth and drilled. Sand is too ponderous, conſequently improper.

Lime, ſoot, coal, and ſoaper's aſhes, are too corroſive and abſorbent to be immediately mixed and drilled with any ſpecies of ſeed or grain.

Seeds that are porous are benefited by being ſteeped in oil, and the oily ſpecies are benefited by alkaline ſteeps.

When the bruſhes of the ſliding regulators touch the cylinders, about one buſhel of wheat or barley per acre is diſcharged through the cavities; and by raiſing the regulators but a quarter of an inch, the quantity of ſeed delivered is greatly increaſed, which any perſon may immediately diſcover, and by the leaſt attention ſoon know how to regulate.

ADVERTISEMENT.

The machine may be ſeen in the Exchange, or at Mr. HANCOCK's, Wheelwright, in the Old Market, BRISTOL.

Orders directed to G. WINTER, BRISTOL, will be duly attended to. Price *Fifteen Pounds.*

" Any Perſon who ſhall directly or in-
" directly make, uſe, or put in practice
" the above Invention, or any part thereof,
" or

" or in any wiſe counterfeit, reſemble or
" imitate the ſame, or ſhall make or cauſe
" to be made any addition thereto, or ſubſtraction therefrom without the licence
" of the ſaid G. WINTER, ſhall be proſecuted as the law directs."——*Extract from the Patent.*

Each Machine will be numbered and marked with the Patentee's name, and an ample Reward will be given to any perſon (whoſe name ſhall be concealed) who will inform the Patentee of any one making or uſing any of the ſaid Machines, who ſhall not be licenced, nor found to be a real Purchaſer.

PROPOSALS

TO THE

PUBLIC.

ANY perſon living within ten miles* of Charlton, in the county of Gloceſter, who will properly cultivate a field of any ſize, and ſoil of equal quality, worth twenty ſhillings per acre; let one part be ſowed with wheat or barley, by the common mode of broad caſting; the other part drilled with my machine, and once hoed: At harveſt, let four ſquare perches of the drilled, and the ſame quantity of the broad caſt be reaped, kept ſeparate, threſhed, and immediately meaſured; and in proportion to an extra crop of fifteen acres of wheat, or twenty-five acres of barley, produced by drilling with my machine, more than is obtained by the common mode of broad caſt ſowing, with the ſeed ſaved, in one ſeaſon; on condition of the amount of ſuch difference in produce being paid to me, valuing the wheat at five ſhillings, or the barley at three ſhillings per Wincheſter buſhel, I will give the machine to ſuch perſon; and if the drilled crop ſhould produce leſs than the broad caſt crop, I will pay the contractor in proportion for that deficiency, ſo as to make the drilled equal with the broad caſt; and for the completion of ſuch agreement,

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* Buſineſs will not permit my going to a greater diſtance.

I am ready to enter into a regular contract with any perſon, at our joint expence.

To prevent the leaſt ſuggeſtion whatever of any kind of evaſion, I will endeavour more particularly to explain my propoſal, by reducing it to ſuch a certain form as I truſt will be perfectly underſtood: viz.

Drill one acre or more with my machine, ſow another acre or more broad caſt, with ſeed of equal quality, on the ſame day, on land of equal goodneſs and culture, in the ſame field, and adjoining to each other; at harveſt let four ſquare perches of each be reaped, immediately threſhed and meaſured; the produce of the four ſquare perches of the drilled wheat being three pecks and ſix pints, amounts (in proportion to one hundred and ſixty perches) to thirty-three buſhels and three pecks per acre. We will now meaſure the produce of the four perches of broad caſt, which being three pecks, amounts to thirty buſhels per acre. Therefore, as one acre of drilled produces thirty-three buſhels and three pecks, of courſe fifteen acres will produce five hundred and ſix and a quarter buſhels; and as one acre of broad caſt produces thirty, fifteen acres will produce four hundred and fifty buſhels.

The general quantity of ſeed wheat uſed for broad caſting being thirty buſhels or upwards for fifteen acres, the ſeed for drilling we will eſtimate at eighteen and three quarters buſhels. Therefore,

The drilled produces -	506¼	buſhels.
The broad caſt - - -	450	
Extra increaſe by drilling	56¼	
Seed ſaved by ditto - -	11¼	
Difference in favor of drilling	67½	buſhels.

Which valued at five ſhillings per buſhel, amounts to ſixteen pounds, ſeventeen ſhillings and ſix-pence, to be then immediately paid to me, as a compenſation for my machine.—But ſhould the difference in favor of drilling fifteen acres, be only ſixty-ſeven and a half pints inſtead of as many buſhels, or more than ſixty-ſeven and a half buſhels, ſuch difference, more or leſs, whatever it may be, muſt be paid to me, and the machine becomes alike the property of the Contractor. And if the crop produced by broad caſting, exceeds the crop produced by drilling, I will then immediately pay to the perſon contracting, in proportion for ſuch deficiency, after the rate of five ſhillings per Wincheſter buſhel, ſo as to make the drilled equal to the broad caſt crop. And I will alſo immediately repay to him his proportion of the contract.

Hence, I preſume that theſe propoſals muſt appear ſufficiently obvious to every diſcerning, rational, and unprejudiced Agriculturiſt.

EXPERIMENTS

ON

MANURES.

IN the month of November, 1777, I planted apple trees; and in order to facilitate their growth, was adviſed to apply rotten dung and earth well mixed, to their roots when planted; the reſult was, the moles ſoon dug under their roots, which were expoſed to the ſeverity of the weather, and by the ſoil lying hollow with the mole's ruts, the drying winds penetrated and killed many of the trees.

In November, 1778, I planted four cherry trees, of equal ſize and ſort, at the four corners of a bed in my garden adjoining to the kitchen; in the year 1780, two appeared much more luxuriant, and produced much greater quantities of fruit than the others. On examination and enquiry, found that the ſervants had thrown the wood aſhes (from which they had made their lye for waſhing) and ſome ſoap ſuds round theſe trees, which had occaſioned their ſuperior growth and produce.

I had two jerinams in the windows of my bed chamber, the one adjoining to my waſh-hand ſtand I frequently moiſtened with the ſoapy water I had waſhed my hands with, which plant, in every reſpect, far excelled the other that had only common water applied to it.

I have alſo applied ſoap ſuds, ſtale urine and barton drainings to my wall fruit trees, and in every inſtance they far excelled every other manure; excluſive of their being applied by watering-pots at a leſs expence, and the walks not injured by wheelbarrows.

I have made ſeveral other ſimilar experiments with ſoap ſuds, urine, &c. which produced ſimilar effects.

In the month of February, 1782, I manured one half of a *Paſture* field with rotten dung, fifteen cart load of thirty buſhels each to an acre; the other half was manured with about two hundred buſhels of ſoaper's aſhes per acre. In the month of May following, ten oxen that I had feeding in an adjoining ground, broke into the manured field which had been hayned for mowing; my bailiff informed me that they had greatly damaged that part manured with the ſoaper's aſhes, without injuring the dunged part. Curioſity induced me to inveſtigate the cauſe, and on the following day, opportunity permitted my going to the field, I opened the gate which led into the hithermoſt part of the ground, which was manured with the dung; a few of the oxen which were near the gate entered; the others ſoon followed; I particularly obſerved that they hurried over the dunged part without eating a blade of graſs, but as ſoon as they came to that part manured with the ſoaper's aſhes, they immediately began eating. This circumſtance fully convinced me of the ſuperiority of ſoaper's aſhes to dung; which I could impute to no other, than the effects of the alkaline ſalts correcting the acidity in the ſoil, by which a much ſweeter herbage was produced, of courſe more palatable to the cattle.

When ſoaper's aſhes could not conveniently be procured, I have experienced a compoſt of dung, ſcrapings of a limeſtone road, and ſcavenger ſtuff, about equal parts, turned once, to be an exceeding good and laſting manure for *Paſtures*, producing great quantities of clover, and an excellent herbage.

Early crops of peas and beans may be procured in the following manner, viz.

In the month of November plant peas and beans at the depth of four inches; when take a quantity of ſoaper's aſhes, or the alkaline manure, mix with it a quantity of train oil, which ſcatter over the covered drills, and let it be well incorporated with the ſoil by raking.

In the months of November 1778 and 1779, I made ſeveral experiments with manures upon ſingle ridges on *Paſture* lands, in order to endeavour to aſcertain the beſt and moſt advantageous for a loamy and a clayey ſoil.

The reſult was, that

Lime alone proved rather injurious.

Lime and earth, and lime with clay, freſhened for a ſeaſon, but were of no real benefit.

Coal aſhes alone, produced a very ſmall quantity of white clover, without increaſing the crop.

Soaper's aſhes, in proportion to a buſhel per ſquare perch, had a very viſible effect, by increaſing the crop and producing great quantities of white clover and ſweet herbage.

Dung, produced a coarſe luxuriant herbage.

Scavenger ſtuff, which is a mixture of coal aſhes and ſtreet dirt, far excelled coal aſhes alone, but was inferior to ſoaper's aſhes.

Salt, 4lb. to a ſquare perch, ranked with the unmanured.

In the year 1778, my workmen in raiſing ſtones for building, dug to a very dark blue ſtratum; it cut like ſoap, it appeared very fat between the fingers, and at firſt view had every appearance of being excellent marle. But in order to aſcertain a better knowledge of its real properties, before I applied it as a manure, I analyſed it in the following manner:

1ſt.—Expoſed it in the open air, it did not fall into powder.

2d.—In pure rain water, it retained its original ſtate.

3d.—It did not efferveſce in, nor blunt the acidity of vinegar.

4th.—Infuſed in diſtilled water, in a gentle heat forty-eight hours, and frequently ſtirred; afterwards it was filtered and a part mixed with, but did not alter the colour of the ſyrup of violets.

5th.—The above filtered infuſion, and ſolution of fixed vegetable alkali, produced no precipitation; but I perceived ſomething ſimilar to a faint purpliſh tinge.

6th.—The evaporated infuſion did not chryſtalize.

7th.—It efferveſced with the ſpirit of nitre.

8th.—It barely appeared to efferveſce with vitriolic acid, but gradually fell into a powder.

9th.—The infuſion made no alteration in the colour of the infuſion of galls.

10th.—It was well worked into a thin cake; burnt in a ſtrong fire; when cold, the colour a pale red; put into water, but did not diſſolve or fall aſunder.

11th.—Part of the burnt cake powdered, put into water, but conveyed no calcareous taſte.

12th.—Dried before the fire, and thrown on fuſed nitre, very few ſparks appeared.

Real marle when expoſed to the atmoſphere, or put into water, falls down into a powder; it effervefces with vinegar and all other acids, which it attracts, blunts, or deſtroys.

Hence what at firſt appeared to me to be good marle, was no other than a clay of a black colour, ſimilar in every other reſpect whatever, to a yellow coloured clay, which I have ſince analyſed, and found to contain the ſame properties.—Nevertheleſs I was determined to lay about five buſhels on an adjoining paſture field, where it this day remains in the ſame unaltered ſtate as when firſt laid on. Therefore I particularly recommend it to every perſon, to be extremely cautious how they apply any manure they do not know the properties of.

As I had many ſtones raiſed from off this bed of blue clay, about one hundred oads of it were dug out, for the purpoſe of making a pool for the uſe of my cattle.

In the month of November, 1779, I broke up a ſmall field containing three acres, about one half of it was ſo ſandy and light, that the late occupier could never obtain twelve buſhels of wheat per acre off this part; this induced me to hall about ſixty loads of the blue clay to the field; and for the purpoſe of diſſolving and correcting any metallic or bad particles the clay contained, which time did not then permit me further to inveſtigate, I had ten cart loads of quick lime mixed with it, and ſpread over the ground. The ſucceeding crop produced twenty-three and one half buſhels of wheat per acre, from land that before had not produced twelve buſhels.

Hence, the pernicious properties being deſtroyed by the lime, the coheſion of the corrected clay added tenacity and fertility to the light ſoil, which has hitherto retained that adheſion; and has ſince produced crops, much ſuperior to the firſt.

The manures which I have found moſt advantageous for *Arable*, ſtiff loams, and clayey ſoils, are quick lime, coal, and ſoaper's aſhes, theſe lighten, abſorb, and correct acidities, diſſolve metallic particles and earthy ſalts, that are thereby converted into neutral ſalts; which, in conjunction with the oily particles in the earth, are rendered miſcible with water, and become the food of plants.

The operations of manures upon different ſoils, are to be accounted for from their known properties, aſcertained by repeated experiments. Hence, every Agriculturiſt ought to ſtudy and know the qualities of different ſoils, as well as manures, that they may be properly applied to each other. This ſcience I deem to be one of the moſt uſeful of all human arts; is ſimilar to a phyſician's knowing the cauſe of diſeaſes, the properties of medicines, and their moſt effectual applications.

And in order that the Agriculturiſt may be enabled to obtain a greater knowledge of the properties of different ſoils and manures, will now proceed to their analyſis, ſo far as is neceſſary and really uſeful.

THE APPLICATION
OF CERTAIN
SUBSTANCES
TO ANALYZE
SOILS AND MANURES.

1ſt.—DISTILL a ſufficient quantity of water, or uſe pure rain water, which has been received in the open air, at a diſtance from ſmoak or duſt; in which infuſe the earth forty-eight hours in a gentle heat, ſtirring it often; when cold, and the earth has ſubſided, filter the water, which will retain the taſte of any metallic or earthy ſalt.—Or

2d.—Drop into the above filtrated infuſion, the ſolution of fixed vegetable alkali, if there be any metallic or earthy ſalt, it will precipitate.

3d.—Evaporate the infuſion, if it contains any neutral ſalt, it will cryſtalize.

4th.—To the filtrated infuſion apply an infuſion of galls, if there be any earthy or metallic ſalt; the colour will be red if alum or copper; a deep purple if iron.

5th.—To the filtrated infuſion apply the ſyrup of violets; if it turns red, the ſoil contains an acid; if green, an abſorbent earth.

☞ All acid bodies effervefce violently when mixed with alkaline ſubſtances, and turn a blue tincture of violets red; whereas alkaline ſubſtances mixed with the ſame tincture turn it green.

6th.—Clay or earth containing calcareous earth, put into vinegar, will efferveſce and blunt or deſtroy the acidity, in proportion to the quantity of calcareous earth contained therein.

7th.—Red and blackiſh ſoils frequently contain iron or other metallic particles, which may be viſibly diſcovered by a microſcope, and may be perceived to glitter, by being expoſed to the ſun's rays.

☞ All metallic and earthy ſalts are poiſonous to vegetation, which with acids, are decompoſed by quick lime, alkaline manures and good tillage.

8th.—Clay and earths, dried and powdered, thrown on fuſed nitre; if a few ſparks are produced it contains a ſmall quantity of oil, and according to the increaſe of deflagration and detonation, ſo in proportion is the richneſs of the land.

9th.—Dry and powder rotten dung, throw it on fuſed nitre, its detonation and deflagration will be very great.

☞ Nitre will melt in the fire and grow red hot; is not inflammable of itſelf, but when oil, or any ſubſtance containing oily particles, is added to it, it will detonate and deflagrate, in proportion to the quantity of oil contained therein.

10th.—Analyſis of marle, ſee p. 332.

11th.—Quick lime yields neither ſalt nor oil by diſtillation, but when mixed with the ſoil, it ſtrongly attracts moiſture, ſaline, and oily ſubſtances, which with metallic particles and acids, are decompoſed and diſſolved by lime.

12th.—Chalk freſh dug, yields neither oil nor ſalt by diſtillation, but when mixed with the ſoil, attracts oils and ſalts; efferveſces with, and abſorbs acids.

1[redacted]s by diſtillation or infuſion, yields neither oil nor ſalt, but attracts moiſture, abſorbs acidities, greatly lightens and adds friability to ſtiff cold ſoils under tillage.

14th.—Wood and all other vegetable aſhes, boiled or infuſed in water, yield a fixed alkaline ſalt by evaporation:

15th.—Urine, yields oils and ſalts by diſtillation and ſublimation.

16th.—In order that I might be enabled to form ſome idea of the effects of the atmoſpherical influences on ſoils, in the month of October, 1782, I pared the turf from a very poor loamy earth, dug up about three quarts, which was divided equally into three flat pans. I dug up a pint more, which was immediately put into a glaſs retort, and diſtilled in a ſmall portable furnace, with a gentle heat for near two hours, I got an ounce [redacted] of water, which had a kind of acid ſulphureous taſte. I gradually increaſed the heat, and in two hours more got about twenty drops of a yellowiſh oily liquor; but unfortunately broke the retort, which at that time put a ſtop to my further proceſs by diſtillation. As part of the retort and the earth remained in the furnace, I increaſed the heat to the higheſt degree I could, and when the fire was extinguiſhed, I found the earth was vitrified. This made me conclude that the ſoil contained ſome ſalt, as ſalt is one of the principal aſſiſtants of vitrification.

17th.—I put a tea-ſpoonful of the dried and pounded earth on the fuſed nitre; it produced a few ſparks, which were the effects of oily particles.

18th.—The three pans were placed in different ſituations.—No. 1 was carried into a cloſet excluded from the air.—No. 2 was placed in an open ſituation, ſo as to be expoſed to the ſun the whole day.—No. 3 was placed near a wall with a north-eaſt aſpect, where it only received the benefit of the morning ſun till ten o'clock. The mould in each pan was carefully turned with a trowel ſix times in twelve months, when I took a tea-ſpoonful out of each pan; the earth was dried, pulveriſed, and throwed on fuſed nitre.—No. 1 produced nearly the ſame quantity of ſparks as when firſt dug.—No. 2 produced twice as many, with a feeble detonation.—No. 3 detonated and deflagrated twice as ſtrong as No. 2. Hence, I conclude from theſe experiments, that No. 1 being excluded from the atmoſphere, received no benefit.— That the atmoſpherical influences imbibed by No. 2, were exhaled by the rays of the ſun, which operated on it the whole day.— That No. 3 being ſhaded the greateſt part of the day from the ſun, it more effectually retained the atmoſperical influences which it had imbibed, than No. 2 which was expoſed to the ſun.

Hence I preſume, and am fully convinced, that all tilled lands are greatly benefited by the effects of air, rain, dew, and froſt; and that the more the ground is ſhaded by the crops thereon, the leſs the exhalation, of courſe the more the moiſture and oily particles are retained therein, and the greater is the putrid fermentation, particularly ariſing from eſculent plants.

☞ All theſe experiments were made for my private uſe only, therefore were not ſo minutely inveſtigated as they ſhould have been for public inſpection.

The beſt lands are generally reſerved for paſtures, and the thinneſt pooreſt ſoils tilled; which, from obſervations and experience, I deem, in many inſtances, to be erroneous.

Rich lands are cultivated at a leſs expence than poor lands, which require more manure, ſeed, and oftentimes more tillage. If the Agriculturiſt will juſtly calculate, and impartially compare the expence and produce, he will find it more to his advantage to pay thirty ſhillings for land that will produce him thirty buſhels of wheat per acre, than to cultivate land worth ten ſhillings, rent free, that will produce only fifteen buſhels per acre, which is deemed a good crop from thin poor ſoils. Where the ground is free from ſprings, ſtoney or rockey, ſuch ſoils may be more advantageouſly adapted to graſſes, particularly St. Foin, which will continue in the land from fourteen to twenty years; and it muſt be a very poor ſoil indeed that will not produce a ton per acre.

I muſt alſo obſerve that very rich ground is improper for corn, becauſe its effects are ſimilar to an over manured ſoil, which makes the plants grow ſo luxuriant, as to run more to leaves and ſtalks than to ſeed, and much more liable to be beat down by tempeſtuous weather.

I will venture to aſſert, that the lands in this kingdom now under tillage, may, by thorough culture, proper management, and drilling, be made to produce at leaſt one fourth part more than they do at preſent.

Experiments in Agriculture are made with little trouble and expence: Inclination,

tion, and a ſtrict attention to their effects, are the principal requiſites.

As the qualities of all ſoils vary conſiderably, every Agriculturiſt ought to make himſelf well acquainted with the nature of his land, as alſo the properties of manures; a judicious application of which, with a proper courſe of crops, and thorough tillage, *are the chief and grand Secrets of Agriculture.*

FINIS.

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